USSR Report

PHYSICS AND MATHEMATICS

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USSR REPORT

Physics and Mathematics

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GENERAL

INSTITUTE OF APPLIED PHYSICS PROBLEMS OPENS IN ARMENIA

Moscow PRAVDA VOSTOKA in Russian No 9, 11 Jan 85 p 1

[Text] An institute of applied physics problems has been added to the system
of institutions of the Armenian Academy of Sciences. This institute has begun
to operate on the basis of a department in which research is being pursued in
the fields of nuclear, acoustic, mathematical and solid-state physics. The
institute has received its own experimental facility, which will help to
accelerate the introduction of research results into the economy.

FTD/SNAP
CSO: 1862/249

ACADEMICIAN V. YE. ZUYEV AWARDED

Moscow SOVETSKAYA ROSSIYA in Russian 29 Jan 85 p 1

[Text] By decree of the Presidium of the USSR Supreme Soviet, the title of
Hero of Socialist Labor has been conferred upon Academician Vladimir
Yevseyevich Zuyev, and he has been awarded the Order of Ler._n and the gold
"Sickle and Hammer" medal for his great service in the advancement of
science, training of scientific personnel, and in connection with this
60th birthday.

A photograph of Zuyev is given.

FTD/SNAP
CSO: 1862/258

STATE PRIZE RECIPIENTS FOR TUNABLE LASERS, THERMODYNAMICS

Leningrad LENINGRADSKAYA PRAVDA in Russian 11 Dec 84 p 1

[Abstract] Photographs are given of five Leningrad residents who are
recipients of the 1984 USSR State Prize. Among them are Doctor of Physical-
Mathematical Sciences Vladimir Davidovich Volosov, senior science associate
of the State Optics Institute imeni Vavilov, who received the award for a
work cycle entitled "Highly Effective Nonlinear Conversion of Frequency in
Crystals and Devlopment of Tunable Sources of Coherent Optical Radiation";
and Candidate of Technical Sciences Georgiy Akopovich Khachkuruzov, senior
science associate of the State Institute of Applied Chemistry, who received
the award for a work-cycle entitled "Development of a System of Data on Thermo-
dynamic Properties of Individual Substances and Products of Combustion."

FTD/SNAP
CSO: 1862/181

ACOUSTICS

THE KONSTANTINOV EFFECT AND ABSORPTION OF SOUND IN INHOMOGENEOUS MEDIA

LEGUSHA, F. F., Leningrad Shipbuilding Institute

[Abstract] This study provides a review of experiments on the Konstantinov effect (the absorption of sound at the boundary between two media). The possibility of exploiting the phenomenon to intensify sound absorption in engineering acoustics is discussed. Visual observation methods for ultrasonic fields are employed to illustrate the design principles of various technical devices. Promising new media exhibiting the thermooptical effect include the vanadium-oxide-based FTIROC [phase-transformation interference reversible optical reflector], and spatial light-modulators based on the surface tension deformation of a liquid layer caused by radiation heating of the liquid. Figures 12, tables 1, references 42: 39 Russian, 3 Western. [172-6900]

TOWARD THE THEORY OF ACOUSTIC SCATTERING ON UNEVEN FREE SURFACE

VORONOVICH, A.G., Institute of Oceanology imeni P.P. Shirshov, USSR Academy of Sciences.

[Abstract] An approximate method is proposed for calculating the scattering of sound on uneven free surfaces based on a power-series expansion for increases in the logarithm of the scattering matrix. This corresponds to making allowances for the first terms of the series of perturbation theory, and that leads essentially to Kirchoff's approximation for large-scale gradual irregularities. The cases of a horizontal plane and a periodic surface are analyzed as examples. An approximation is described that makes it possible

to allow for processes which are significant for scattering on large- as
well as small-scale surface components responsible for scattering in mirror
and non-mirror directions. References 8: 4 Russian, 4 Western.
[6900-163]

NEW APPROXIMATIONS AND FINDINGS OF THEORY OF NONLINEAR ACOUSTIC BEAMS

LAPIDUS, Yu. R. and RUDENKO, O.V., Moscow State University imeni N.V.
Lomonosov.

[Abstract] This study addresses approaches to the solution of problems
arising in the theory of nonlinear propagation effects of high-intensity
spatially localized acoustic waves. A modified theory is proposed that pro-
vides more complete information about nonlinear diffraction processes in
acoustic beams. The domains of applicability of the first and second
approximations are identified. The determination of peak values is explained.
The analytical findings are compared with the results of computer calculations.
References: 8 Russian.
[6900-163]

REFLECTION OF ACOUSTIC BEAM FROM INHOMOGENEOUS BOUNDARY

LAPIN, A.D., Acoustics Institute imeni N.N. Andreyev, USSR Academy of
Sciences.

[Abstract] The effective coefficient of reflection of an acoustic beam incident
normally on an inhomogeneous boundary characterized by elastic-type acoustic
conductivity is calculated. The analysis is performed within the framework
of the modified perturbation theory, with allowance for the terms of
the second order with respect to the amplitude of inhomogeneities. It is
found that practically all of the acoustic energy of the beam is converted
to surface waves when the wave numbers of the bulk and surface waves are
close to one another. References: 7 Russian.
[6900-163]

CRYSTALS AND SEMI-CONDUCTORS

INFLUENCE ON BI-PHONON STATES ON RAMAN SCATTERING OF LIGHT IN MOLECULAR CRYSTALS

ZAVOROTNEV, Yu.D., OVANDER, L.N. and STEFANOVICH, L.I.

[Abstract] The excitation of bi-phonons formed from intra-molecular vibrations is investigated by the resonance Raman light scattering method, in which the pumping frequency is close to the frequency of the two-particle state, i.e., the conditions of polariton Fermi resonance are satisfied. The connection between the energy flux of the scattered radiation and the nonlinear polarizability tensor is identified. Raman light scattering tensor selection rules which make it possible to investigate various bi-exciton states by choosing the scattering geometry are investigated. It is found through investigating those bi-phonon states formed from the phonons in the same zone that not all of the scattered radiation lines are resonant as the pumping frequency approaches a particular bi-phonon level. Figures 3; references: 13 Russian.
[146-6900]

X-RAY DIFFRACTOMETRIC MEASUREMENTS AND CALCULATIONS OF LIMITING VALUES OF DISCREPANCY BETWEEN LATTICES AND LAYER THICKNESSES, PREVENTING GENERATION OF DISLOCATIONS DURING GROWTH OF MULTILAYER HETEROSTRUCTURES

BOKIY, G.B., corresponding member, USSR Academy of Sciences and KUZNETSOV, G.F., Radio Engineering and Electronics Institute, USSR Academy of Sciences

[Abstract] A theoretical functional relationship is proposed between the critical parameters for any heterolayer in a multilayer heterostructure and

the experimentally measured discrepancies and thicknesses of all of the layers
in the heterostructures; this relationship is verified experimentally by
comparing data from X-ray diffractometry and X-ray topographic analyses.
The generation of dislocations in each of the heterolayers of a dual
heterostructure is confirmed by X-ray topography only when the actual thick-
ness of the heterolayer exceeds its calculated critical thickness. Other-
wise, no dislocations are generated during the growth processes when incon-
gruities are registered in the dual heterostructures. The formulas derived
can be used for X-ray diffractometry measurements and analysis of the charac-
teristic prameters of any type of multilayer heterostructures. Tables 2,
references 12: 10 Russian, 2 Western.
/171-6900/

INFLUENCE OF COHERENT LIGHT BEAMS ON FREE CARRIERS IN SEMICONDUCTORS

DYKMAN, I.M. and TOMCHUK, P.M., Semiconductors Institute, Ukrainian SSR
Academy of Sciences.

/Abstract/ A semiconductor exposed to several coherent beams of light
waves is examined. It is assumed that because $h\omega$ is smaller than the width
of the forbidden zone, the light is capable only of redistribution of the
electron concentration, while the total number of electrons in the semicon-
ductor remains constant. Wave interference modulates the probability of
electron scattering and the power they absorb, exerting light pressure on
the electron gas. A kinetic equation is derived for the problem which
allows for these factors. The detection of effects caused by the formation
of super lattices are discussed, and their parameters are defined.
References: 5 Russian.
/106-6900/

LFTI'S WORK IN SEMICONDUCTORS, OPTICS, THERMONUCLEAR FUSION

Moscow PRAVDA in Russian 16 Jan 85 p 3

[Article by S. Grachev (Leningrad)]

[Excerpt] Although it would be difficult to enumerate in brief form the range of problems that are being studied at the USSR Academy of Sciences' Physical-Technical Institute, they nevertheless all have a common trait-- they are fundamentally innovative. One example of this is the scientific direction which is led by the institute's director, Academician Vladimir Maksimovich Tuchkevich. He developed the world's first power semiconductor devices, which literally revolutionized many branches of the electrical equipment industry.

Twenty years ago, a group of young scientists headed by Zhores Ivanovich Alferov was formed out of Tuchevich's laboratory. This group undertook studies of phenomena occurring at the interface of two semiconductors with different chemical properties. The laboratory of contact phenomena in semi- conductors developed single crystals with entirely new properties, and the world's first semiconductor lasers were developed on their basis.

These developments led in turn to the creation of fiber-optic communication lines, and systems of optical recording and reproduction of information. Today semiconductor heterostructures are on the verge of bringing about far- reaching changes in microelectronics. With them, it will be possible to increase the speed of computers by many times while reducing the size of the machines substantially, and also to develop new instruments and tech- nologies.

"Planned discoveries"--this term seems paradoxical at first. But it is interesting to note that today the institute is taking part in the realiza- tion of 12 major topics of the Leningrad regional [high-technology] program called "Intensifikatsiya-90."

I'll mention just a few of them. Mention already was made of the develop- ment of a component base for high-speed computers and optical communication lines. This problem involves efforts of scientists of four other labora- tories of the institute. Another important problem is the development of new materials for holographic systems of the "robot eye" type. And the

institute is working together with other Leningrad institutes on research in controlled thermonuclear fusion.

In one of the institute's rooms I was shown an immense unit for investigating conditions of thermonuclear fusion. It is called the "Tuman-3." Today it is believed that units of the "Tokamak" type (the "Tuman-3" belongs to this type) undoubtedly will serve as the prototypes of thermonuclear power stations.

But a whole series of problems must be solved before this is accomplished. First among them is to study hot plasma more thoroughly, under its working parameters, which means heating it to 100 million degrees. With respect to [plasma] diagnostics, it is being performed in all Soviet and many foreign laboratories with the aid of methods and equipment that were developed at the physical-technical institute under the direction of Prof V. Afrosimov. Methods of heating plasma are being investigated by the laboratory of hot plasma physics. Prof V. Golant, the head of this laboratory related:

"The working parameters of plasma most likely will be attained by scientists in large units of the 'Tokamak' type in the years immediately ahead. Then will come the period of engineering design for construction of a reactor. The final stage should begin sometime around the turn of the century. Then humanity finally will gain access to new sources of energy."

FTD/SNAP
CSO: 1862/258

UDC 535.373

LUMINESCENCE AND ABSORPTION OF INDIUM-ACTIVATED POTASSIUM-BORATE GLASSES
SUBJECTED TO HIGH-POWER EXCITATION

BELYY, S.Ye., ZELENSKIY, S.Ye., OKHRIMENKO, B.A. and YABLOCHKOV, S.M.

[Abstract] The interaction between indium-activated potassium-borate
glasses and the radiation from a pulsed neodymium laser is investigated.
Specimens of $K_2O \cdot 7B_2O_3$ are irradiated by fourth-harmonic focused radiation
from a neodymium laser (265 nm, pulse length about 10 ns), revealing a long,
nonexponential component in the attenuation of the luminescence. This fact
is interpreted within the framework of the model of recombination lumin-
escence. The variations in the luminescence and absorption spectra of
potassium borate glass are found to be stable and to be associated with the
occurrence of new luminescence spectra caused by photoionization of In^+
-centers. References: 3 Russian.
[40-6900]

UDC 535.375

GENERATION AND AMPLIFICATION OF RADIATION DURING STIMULATED RAMAN SCATTERING
IN CRYSTALS

KARPUKHIN, S.N. and YASHIN, V.Ye.

[Abstract] This study investigates the exploitation of four-photon
parametric processes, which make it possible to improve conversion
efficiency and stability during stimulated Raman counter-scattering in
crystals in the wavefront conjugation mode. The generation of Stokes
radiation in focused beams during stimulated Raman scattering is investigated
experimentally in calcite and barium nitrate crystals. Efficiency of about

0.8 is achieved in converting pumping energy to Stokes radiation during
stimulated Raman counter-scattering. Wavefront conjugation performance is
measured for spatially homogeneous and inhomogeneous beams. It is found
that wavefront conjugation performance is improved as the pumping energy
is increased. Further amplification of the radiation is achieved in a
barium nitrate laser in the averaging mode: conversion efficiency of
approximately 0.8 is obtained during saturation, and amplification of about
$1.3 \cdot 10^3$ is achieved for weak input signals. Figures 6; references 23:
19 Russian, 4 Western.
/148-6900/

ABSORPTION OF 10.6 μm LASER RADIATION IN ELECTRON-HOLE CONDENSATE IN
GERMANIUM

KALINUSHKIN, V.P., MANENKOV, A.A., MIKHAYLOVA, G.N. and SOKOLOV, S. Yu.,
General Physics Institute, USSR Academy of Sciences.

/Abstract/ This study describes experiments conducted to determine the
absorption cross-section of the electron-hole fluid in uncompressed germanium
and an irregularly deformed germanium crystal during the formation of small
electron-hole droplets. The change in transmission (modulation percentage)
of probe radiation from a CO_2 laser by the specimen, caused by the generation
of nonequilibrium carriers in the crystal, is measured at T = 300 and 1.6 K.
The absorption cross-section at T = 1.6 K was estimated by comparing the modu-
lation percentages of probe radiation at 300 and 1.6 K. A modulation per-
centage of about 7 is obtained for deformed and undeformed germanium speci-
mens at 1.6 K. The attenuation signal at T = 300 K in the deformed specimen
was the same as that for the undeformed one. The experimental values ob-
tained for the attenuation of radiation in an electron-hole liquid are thus
the same in irregularly deformed and uncompressed germanium. References 12:
7 Russian, 5 Western.
/129-6900/

CLASSICAL EMISSION OF RELATIVISTIC CHARGED PARTICLES DURING AXIAL CHANNELING

KHOLOMAY, B.V., Department of Theoretical Physics.

[Abstract] The solution of relativistic equations of motion in arbitrary
axisymmetrical electrical focusing fields is employed to study the high-
frequency emission of relativistic charged particles during axial channeling
in crystals. A solution is sought to the relativistic 'steady-state'
Hamilton-Jacobi equation in a cylindrical coordinate system. In spite of
the difficulty in determining the actual electrical field potential for
channelled particles, the basic principles of relativistic particle move-
ment during axial channeling can be obtained for an arbitrary focusing elec-
trical field on the assumption that the charge moves in a spiral and fluc-
tuates little in the vicinity of the equilibrium radius. An expression is
derived for the spectral-angular distribution of the time-averaged total
radiated power. References 11: 9 Russian, 2 Western.
[104-6900]

CONDUCTORS MADE OF SULFUR

Moscow IZVESTIYA in Russian 4 Dec 84 p 3

[Text] Is it possible to say that a temperature of -243°C
is "unprecedentedly high?" That is, in fact, how special-
ists define the conditions for a recent experiment con-
ducted at the Institute of High Pressure Physics (IFVD) AN
SSSR. When cooled "only" to this temperature, and not to
a temperature close to absolute zero, ordinary yellow
sulfur becomes....an ideal conductor for electric current;
this fact opens new prospects in the theory and application
of superconductivity.

In the eighteenth century, the European public flocked to the so-called "physics
theaters," where scientists-teachers charmed the curious spectators with scores
of experiments never seen before. Alas, today there are not spectators at such
performances, although the scientific "acts" being performed have become quite
dramatic: in the century of the Scientific and Technical Revolution, scientists
have come much closer to discovering the secrets of matter than their great-
great-great-grandfathers did.

These "showmen-physicists" usually spend years bringing their secret ideas to
fruition; the actual "staging" falls on the shoulders of the organizers, ex-
perimenters, suppliers, laboratory technicians, economists and plotters.

So, the play is ready, the laboratory is set up as usual. The suction pumps
are smacking prosaically, the flasks of liquid nitrogen and helium are slightly
covered with frost, and the hoses which carry these supercold liquids are frozen.
In the middle of the room there is a steel cylinder, a cryostat. Inside its
hermetically sealed walls, behind layers of high vacuum, a small press floats
in liquid helium, blocking the path of warmth from outside. A rod of ordinary
yellow sulfur is inserted between anvils made of artificial crystal. Scores of
sensors transmit information about its condition to the room.

The press is turned on, the pressure increases to 500,000 atm. and, beginning at
a temperature of -243°C, an electric current begins to pass through the cold
sulfur with zero loss. This level is unprecedentedly high; until then the
record belonged to germanide niobium, now it is bettered by 7 degrees!

At one point theoreticians proposed a very plausible idea: that all elements of the Periodic Table should be either magnets or superconductors, i.e., able to conduct current without loss. Ferromagnets such as iron, nickle and cobalt are well-known, but superconductors (mercury, lead, tin) were discovered only at the beginning of this century, although today such properties are found in half a hundred elements, to say nothing of thousands of exotic alloys and chemical compounds.

Under ordinary conditions only metals conduct electric current, but about 10 years ago a group of IFVD AN SSSR scientists under the direction of academician L. Bereshchagina discovered that even sulfur can become a superconductor at superhigh pressures and superlow temperatures. Today about a dozen such "anomalous" substances are known, including silicon, phosphorus, arsenic, lutecium, and even the gas xenon. American physicists from Cornell University and General Electric tested and substantiated the superconductivity of sulfur which was first discovered by Soviet scientists.

So much for theory and experiments; what does all this exotica have to do with everyday life?

"First of all," says scientist and Secretary of the Institute V. Begoulev, the properties of a well-known substance turned out to be richer than we thought. Sulfur has long been used to fight diseases in plants and humans, to manufacture rubber and to produce electricity by friction; now it can be a fantastic conductor. Electrotechnicians should be able to appreciate how useful electric cables with sulfur conductors will be."

"This fact, which we have recorded, is especially important for understanding the structure of matter," adds the Director of the Institute, Doctor of Physical and Mathematical Sciences E. Yakovlev, who is currenlty directing a series of studies on the superconductivity of sulfur. "The world in which we live, it seems, is superconductive! Soviet theoreticians have already suggested such a hypothesis; we're just confirming the theory with facts."

Our laboratory "performance" is especially entertaining since, although the sulfur research is serious, it is only one small part of the Great Hunt for Hydrogen! Scientists have long been able to compress that gas even and change it into a solid. Specialists hope to learn how to turn it into a metal which would remain a "metallic superconductor" even without high pressures and at room temperature. If so, then such hydrogen rods would bring about a revolution in power engineering, and one out of ten kilowatts of power now being lost in unproductive heating of ordinary aluminum or copper conductors would be saved.

<div style="text-align:right">

V. Okolotin, Doctoral Student in Technical
Sciences
N. Golovkova

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FRUITS OF COOPERATION AMONG PHYSICISTS

Moscow IZVESTIYA in Russian 21 Sep 84 p 2

[Article by I. Novodvorskiy]

[Text] On 20 September 1984, the USSR State Committee on Inventions and Discoveries registered a discovery in the field of semiconductor physics. The discovery was made as a result of many years of cooperation between the Soviet and East German academies of sciences. The authors of the discovery were co-workers of the Central Institute of Electronic Physics of the East German Academy of Sciences, Doctor of Natural Sciences M. Asche and Candidate of Physical and Mathematical Sciences H. Kostial, and Soviet physicists Doctor of Physical and Mathematical Sciences Z. Gribnikov, Candidate of Physical and Mathematical Sciences V. Mitin from the Institute of Semiconductors, UkSSR Academy of Sciences, and Doctor of Physical and Mathematical Sciences O. Sarbey from the Institute of Physics, UkSSR Academy of Sciences.

Various characteristics of crystals such as strength, electrical conductivity and many others depend on the direction along which these characteristics are measured. A mica plate splits readily along one direction, and with incredible difficulty in another. Anisotropy (as physicists call this effect) is one of the features that distinguish a crystal from an amorphous substance.

It had always been assumed that the values of crystal characteristics depended solely on the direction in which they were measured, but not on the point where the measurement was being made. The authors of the discovery have established that some (primarily electrical) properties depend differently on direction in different zones of a crystal, i. e., the crystal seemingly stratifies into regions stretched out parallel to the current.

The anisotropy discovered by the researchers increases quite abruptly when the electric field reaches a certain critical level.

The discovered effect has considerably changed physicists' ideas about the properties of semiconductor crystals. Instruments that are highly sensitive to magnetic field and pressure can be developed on the basis of this phenomenon.

6610
CSO: 1862/72

UDC 666.651.5

SYSTEM FOR ELECTRO-OPTICAL CERAMIC RECRYSTALLIZATION

LIVIN'SH, M.G., PININS, T.Ya., SEGLIN'SH, Ya.A. and ZVIRGZDS, Yu.A.,
Scientific Research Institute for Solid State Physics, Latvian State
University imeni P. Stuchki.

/Abstract/ A hot pressing system for obtaining electro-optical ceramic
blanks up to 100 mm in diameter and up to 30 mm high is described which
makes it possible to realize recrystallization in a vacuum and in an
oxidizing atmosphere without cooling the specimen between cycles. The
device consists of a press, a heating chamber and support systems. Experi-
mental operation of the first model of this system for twelve months proved
the reliability and convenience of the design, but also disclosed a number
of deficient elements, which were corrected in the present model. By using
this system, the length of the technological recrystallization cycle can be
shortened by up to 50% as compared with hot pressing in two separate systems;
the number of rejects can be reduced during the recrystallization stage by
reducing the number of heating-cooling cycles; and optically homogeneous
electro-optical ceramic can be produced which provides light transmission
close to the theoretical limit. References 2: 1 Russian, 1 Western.
/126-6900/

DEFECT FORMATION IN AMORPHOUS HYDRATED SILICON SUBJECTED TO LASER RADIATION

CHUKICHEVA, G.M., ZARIF'YANTS, Yu.A., KARYAGIN, S.N., KASHKAROV, P.K. and
PETROV, A.V.

/Abstract/ The reduction in capacitive photo-emf in amorphous hydrated sili-
con exposed to pulses from an Nd laser is investigated by photoluminescence

and electron paramagnetic resonance methods at 10 GHz. The photoluminescence spectral distribution of the a-Si:H film at 77 K shows a sharp increase in the intensity of the 0.85-eV band after irradiation of the specimen by laser pulses at approximately 0.1 MW/cm^2, while the parameters of the primary band changed insignificantly. The increase in the intensity of the 0.85-eV band provides direct evidence of the formation of intrinsic defects in a-Si:H, similar to that observed elsewhere as the result of Ar$^+$ ion implantation, electron bombardment and following long-term irradiation with light at 5 W/cm^2. Spin centers are cited as one of the possible types of defects that are formed as the result of breaking the Si-H bonds. The shift in the g-factor of the electron paramagnetic resonance signal indicates a change in the coordination circumference of the Si centers. References 8: 2 Russian, 6 Western.
/134-6900/

QUASI-STEADY-STATE MELTING MODE DURING COMBINED LASER IRRADIATION OF SEMICONDUCTOR MATERIALS

ABAKUMOV, V.N., GUMAN, V.N. and YUFEREV, V.S., Physical-Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences.

/Abstract/ The concentration of heat sources created by the absorption of laser radiation striking a substance in the vicinity of a melting front, and their advancement along with the front, are investigated. A simple analytical solution to Stefan's problem for this laser irradiation mode is found. The temperature field distributions are obtained and expressions are derived for the rate of melting front movement during combined exposure to laser pulses with nanosecond, microsecond and millisecond durations. Although the analysis does not contradict experimental findings elsewhere, the theory cannot be compared quantitatively with those experiments inasmuch as the latter are qualitative in nature. References 9: 5 Russian, 4 Western.
/134-6900/

INTER-ZONE AUGER RECOMBINATION IN GaSb LASER STRUCTURES

GEL'MONT, B.L., SOKOLOVA, Z.N. and KHALFIN, V.B., Physical-Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences.

/Abstract/ This study investigates the influence of inter-zone Auger recombination on the threshold current of heterolasers with an active region consisting of an undoped semiconductor in which the width of the forbidden

zone is approximately the same as the spin-orbital splitting. The inter-
zone Auger recombination weights are computed using Kane's model; the
radiative recombination rates in GaSb laser heterostructures are computed.
The threshold current density and internal luminescence quantum efficiency
are found. It is demonstrated analytically that the fundamental Auger
recombination mechanism essentially does not increase the threshold current
density in GaSb lasers and lasers with similar solid solution composition.
The threshold current densities are found to be significantly higher at room
temperature, which is explained either on the basis of large optical losses
in the structure, or recombination involving impurities. References 18:
12 Russian, 6 Western.
/134-6900/

PHOTO-ACOUSTIC EFFECT IN FINITE-DIMENSIONAL SEMICONDUCTORS

VASIL'EV, A.N. and SANDOMIRSKIY, V.B., Radio Engineering and Electronics
Institute, USSR Academy of Sciences.

[Abstract] The photo-acoustic effect, defined as the generation of temperature
waves in a specimen as a result of the absorption of unsteady radiation
followed by the formation of acoustic oscillations in the specimen or the
surrounding medium, is examined in a semiconductor of finite thickness with
allowance for surface recombination and heat release from the rear boundary.
The surface temperature is investigated numerically as a function of fre-
quency. Approximate expressions are obtained for the heat sources in the
specimen. Simple analytical expressions are obtained for the amplitude of
the photo-acoustic effect which agree quantiatively with the features of the
graphs. The photoacoustic effect is shown to determine a number of the
electronic thermal and geometric characteristics of the specimens.
References 7: 2 Russian, 5 Western.
/134-6900/

UDC 621.315.592

EFFECT OF POWERFUL PULSED LOW-ENERGY ION STREAMS ON GaAs

BITYURIN, Yu.A., GAPONOV, S.V., KLYUYENKOV, Ye.B. and STRIKOVSKIY, M.D.,
Institute of Applied Physics, USSR Academy of Sciences.

[Abstract] The compensation effect of Gallium arsenide bombarded by intense
streams of low-energy arsenic ions is investigated in an experimental setup

similar to that employed for laser spraying and epitaxy. It is found that compensation at irradiation temperatures of 350 - 500°C is associated with the migration of primary radiation defects in the GaAs, and the formation of intricate complexes in a nonlinear mode with respect to the radiation intensity. The radiation intensity is found to have a strong influence on the depth of compensation, and the influence is not associated with change in the diffusion length of the vacancies. A phenomenological model of the process is proposed which assumes the accumulation of divacancy - donor atom complexes through an intermediate short-lived state. By combining high density of the bombarding stream and heating of the semiconductor, it is thus possible to obtain 'injected' radiation-stimulated self-compensation under the radiation conditions described here. References 15: 11 Russian, 4 Western. /134-6900/

INFLUENCE OF 'BACKGROUND' ELECTRICALLY NEUTRAL ARGON ADMIXTURE ON MECHANICAL STRENGTH OF SILICON CRYSTALS

KOLOMOYETS, V.V., SIMONENKO, Yu.V. and FEDOSOV, A.V., Semiconductors Institute, Ukrainian SSR Academy of Sciences, Kiev.

[Abstract] The influence of local elastic stresses on the mechanical characteristics of silicon crystals, which determines the reliability of silicon devices operating under severe mechanical conditions, is determined directly by comparing the effect of changing the resistance of uniaxially compressed crystals. Two batches of specimens were made from two Si ingots doped with electrically active phosphorous. One of the ingots was grown in argon, resulting in a residual 'background' argon impurity; the other ingot was grown in a vacuum. It was found that specimens containing traces of argon broke down under mechanical stress of 15.8 ± 1 tonne/cm^2, while specimens made from the ingot grown in a vacuum broke down at 21.8 ± 1 tonne/cm^2: the presence of argon traces in the specimens reduced their mechanical breakdown strength by approximately a factor of 1.4. Figures 2; references 15: 11 Russian, 4 Western.
/132-6900/

FLUID MECHANICS

UDC 532.526

DEVELOPMENT OF ARTIFICIALLY PRODUCED PERTURBATIONS IN SUPERSONIC BOUNDARY
LAYER

KOSINOV, A.D. and MASLOV, A.A., Novosibirsk

[Abstract] A method is proposed for inducing artificial perturbations of
the regulated amplitude in a supersonic boundary layer. The proposed
method is used to investigate the development of a three-dimensional low-
intensity wave packet at 20 KHz in the boundary layer of a flat plate at
Mach number M = 2.0. The Fourier components of the wave packet are defined.
The resulting data are compared with the result of calculating the linear
stability of a supersonic boundary layer performed using the approximation
of a plane-parallel flow. The measurements were made in a wind tunnel in the
boundary layer of a flat steel plate with a sharp leading edge chamfered to
an angle of 14° 30'. The model was held horizontally in the center plane
of the working section of the wind tunnel at an angle of attack of zero.
The perturbation source was an AC electrical discharge. The measured Fourier
components of the wave packet were compared with the calculated figures in
terms of the linear theory of hydrodynamic stability. The theoretical and
experimental data agree qualitatively overall. For angles exceeding 40°
the amount of growth calculated by the theory of plane-parallel flows is
significantly smaller than the experimental figure. Figures 4; references
15: 11 Russian, 4 Western.
[128-6900]

UDC 532.517

THEORETICAL FOUNDATIONS OF TURBULENT FLOWS

STRUMINSKIY, V. V., Academician, Division of Mechanics of Inhomogeneous Media, USSR Academy of Sciences

[Abstract] It was pointed out that since the Boltzmann equation can be derived from the principles of mechanics and statistics and that this equation can, in principal, describe only laminar motions of fluids (the Navier-Stokes equations being the first-order averaged equations derived from the Boltzmann equation), turbulent fluid motions can only be described by constructing more general solutions based on the Liouville equation. A general approach to obtaining such a solution was outlined based on the concept of groups of particles, some of which can be in an equilibrium state at the same time that others are in a nonequilibrium state. Each group is viewed as a particle-like dynamic entity and a system of coupled collision equations, whose form is similar to the collision equation in the Boltzmann theory but which now describe the kinetics of the system of groups, is constructed. This system of equations can be reduced to a closed system of equations for describing turbulent motions, in contrast to classical approaches to turbulence which lead to an infinite system which must be truncated. References 8; 4 Western.
[242-9638]

UDC 537.311.33

TOWARD THE PROPAGATION OF WAVES IN UNSTEADY MEDIA

PAVLOV, V.I., MAMATKULOV, M. and KHABIBULLAYEV, B.K., Tashkent State Pedagogical Institute imeni Nizami.

[Abstract] Variation in the speed of sound in unsteady media caused by changes in physical and chemical properties are investigated analytically. A truncated equation is derived to describe wave propagation in unsteady media. Steady waves are found to exist in unsteady media when nonlinearity is taken into account. Figures 1; references: 2 Russian.
[6900-16I]

EXACT SOLUTIONS OF SINGULAR EQUATIONS FOR VISCOUS TRANSSONIC FLOWS

ZASORIN, Yu.V., Voronezh State University imeni Lenin Komsomol.

[Abstract] An exact solution is sought to the equation for viscuous
transsonic flow,

$$\left(\frac{\partial^3}{\partial x^3} + \frac{\nu}{y}\frac{\partial}{\partial y} + \frac{\partial^2}{\partial y^2} \right) \dot{u} = \frac{\partial^2 u}{\partial x^2}\frac{\partial u}{\partial x}$$

Explicit fundamental

solutions are constructed for a system of hypoelliptical operators with
singular coefficients. Asymptotic expansions of these solutions are
found. The exact formula for the Green's function of certain boundary
problems and the rate of decrease at infinity of the solutions of the
homogeneous equation are investigated within the class of moderate growth
distributions. References 6 Russian.
[122-6900]

LAW OF THE TWINKLING OF STARS

Moscow IZVESTIYA in Russian 20 Oct 84 p 2

[Article by I. Novodvorskiy]

[Text] On 19 October 1984 the USSR State Committee for Inventions and Discoveries registered a discovery in the field of atmospheric physics made by Academician A. Obukhov.

The term "turbulence" is not familiar to everyone, but everyone has seen turbulence. Turbulence is the vortical motion of a fluid or gas, especially air: a gusty wind, smoke wreathing from a chimney and many other such phenomena. Not only does air velocity change randomly, but air temperature as well. A thermometer hanging outside a window cannot show these fluctuations: it is too unwieldy, has a low response and is too inert for this purpose. However, temperature fluctuations are present everywhere in the atmosphere.

The law which has been defined by A. Obukhov has related the characteristics of temperature fluctuations of a turbulent flow and the scattering of kinetic energy and the rate of evening-out of temperature. These phenomena are caused by the decay of large eddies, in which a nonuniformity of temperatures persists, into smaller eddies. The dissipation of energy and evening-out of temperatures occurs in them.

The author of this discovery has succeeded in establishing quantitative dependences of the temperature characteristics of the turbulent flow on the parameters of these phenomena.

The practical importance of the Obukhov law is that it makes it possible to compute the disturbances of light and radio waves passing through the atmosphere. It is interesting that the scintillation of stars is related precisely to such disturbances. But, to be sure, it is not the scintillation of stars which is most important; the assurance of reliable radio communication and radar, laser communication and laser ranging -- this is where a knowledge of the newly discovered law should be of assistance to specialists.

5303
CSO: 1862/121

UDC 533.6.01.72

EXPLOSION IN FLIGHT

SHURSHALOV, L.V., Moscow

/Abstract7 The explosion of a body in flight is modeled as the process of
expansion of a volume of compressed part gas into the surrounding medium.
The analysis is performed by S.K. Godunov's finite-difference method, in
which the shock wave serves as a movable boundary in the analytical grid,
and the contact explosion is 'visualized' with the help of markers. It is
found that there is a slight shift of the perturbed region of the flow, with
respect to the initial center point, in the direction of the initial velocity;
the parameters of the shock wave are amplified significantly; the temperature
increases in the zone ahead of the moving volume and decreases behind it.
Even when the contribution of kinet   energy is relatively small, it is
found that the deviations from the corresponding unidimensional explosive flow
are significant, especially when the initial density of the body is high.
This is particularly the case when the kinetic energy is comparable with,
or exceeds, the explosion energy. Figures 3; references: 6 Russian.
/I28-6900/

LASERS AND MASERS

UDC 621.373:535

INVESTIGATION OF REPRODUCIBILITY OF EMISSION WAVELENGTH OF HELIUM-NEON
LASER WITH EXTERNAL NEON ABSORPTION CELL (0.63 μm)

PRIVALOV, V.Ye. and CHULYAYEVA, Ye.G.

[Abstract] A stabilized LG-149-1 helium-neon laser with an external neon
cell in a longitudinal magnetic field is investigated and found to provide
wavelength reproducibility of 10^7, rather than the limiting values of
10^8 - 10^9, due to shifts in the emission frequency. Frequency reproduci-
bility is measured by a method utilizing a matrix of the frequency intervals
formed by the published spread in the electrical parameters of the laser.
The matrix provides a graphic representation of how changes in particular
parameters influence shifts in frequency, and makes it possible to estimate
the best-case situation. In the worse case, the frequency is combined,
i.e., the reproducibility is determined by the sum of the diagonal elements
of the matrix. Recommendations are given for ways of providing instrument-
to-instrument wavelength reproducibility of $1 \cdot 10^8$. References 7:
6 Russian, 1 Western.
[146-6900]

PROSPECTS FOR LASERS FOR FUSION ENERGY ASSESSED

Moscow MOSKOVSKIY KOMSOMOLETS in Russian 20 Jan 85 p 4

[Article by N. Basov, academician, director of the USSR Academy of Sciences' Physics Institute imeni Lebedev, laureate of the Lenin and Nobel prizes, and V. Rozanov, professor, laureate of the Lenin and USSR State prizes]

[Abstract] The authors assess the status of laser thermonuclear fusion research in the USSR and abroad, reviewing some of its major advances as well as current objectives of scientists working in this field. It is recalled that the world's first laser unit for spherical compression of a thermonuclear target was built in the USSR. This nine-beam unit, called the "Kal'mar," was put into operation at the USSR Academy of Sciences' Physics Institute in 1970. Its successor, a 108-beam unit called "Del'fin," went into service in 1980. These units employ neodymium glass lasers.

Looking ahead, the authors comment: "What are the future prospects in this direction? The development of an experimental laser thermonuclear reactor is possible in the next 10 to 15 years. Many physics and engineering problems have to be solved before it is developed.

"The most important physics problem is to achieve experimentally a thermonuclear microexplosion from which the energy that is obtained substantially exceeds the laser energy. A large laser unit with a radiation energy of about 1 megajoule is needed for such an experiment. Specialists think that there are no obstacles in principle to this. It is a question of investing a sufficiently large sum of resources in the accomplishment of this task. A unit with an energy of 0.1 megajoule will go into service in the United States this year. It is anticipated that the physical threshold of a reaction in which the thermonuclear reaction's energy equals that of the laser energy will be achieved with the aid of this unit.

"Of course, the biggest physics and engineering task is to develop a laser capable of operating in the conditions that are necessary for a thermonuclear reactor. Such a laser must operate with a pulse repetition frequency of 1 to 10 pulses per second, and it must have a service life of about 100 million pulses. It will be made up of individual modules (10-20 modules) with an overall energy of 2-3 megajoules, and it will ensure stable focusing of radiation on a target about 1 centimeter in size from a distance

of about 50 meters. Its efficiency will be adequate and its cost low enough. Lasers of several types (including carbon-dioxide lasers and chemical and excimer lasers based on a mixture of noble gases with halogen) can meet these requirements, but incorporating them in a single unit is quite difficult from the engineering standpoint. The development of modules of such lasers is also an important task."

FTD/SNAP
CSO: 1862/258

GENERATION OF SINGLE NANOSECOND HIGH-CONTRAST RADIATION PULSE
(λ - 10.6 μm)

APOLLONOV, V.V., BAYTSUR, U.G., BRYTKOV, V.V., ZIYENKO, S.I., MURAV'EV, S.V.,
SOROCHENKO, V.R., FIRSOV, K.N., SHAKIR, Yu.A., and YAMSHCHIKOV, V.A.,
General Physics Institute, USSR Academy of Sciences.

[Abstract] The regenerative amplifier-based master oscillator of the
Polinom laser system is described. The master oscillator is made up of three
blocks: the first generates a high-contrast nanosecond pulse for injection
into the regenerative amplifier; the second is the regenerative amplifer,
which outputs a nanosecond pulse train; the third converts the pulse train
to a single high-contrast pulse. A tunable LG-74 laser is the radiation
source. The regenerative amplifier is made up of a pair of amplifier modules
which produce a train of nanosecond pulses against the background of the
intrinsic radiation. Measurements of the working parameters of each block
are described. The Polinom laser system produces energy of 0.5 J, with half-
height duration of 3 ns, contrast exceeding 10^6 and divergence of
approximately $5 \cdot 10^{-4}$. References 7: 5 Russian, 2 Western.
[139-6900]

LASER "ELEKTRONIKA-01" FOR AIR POLLUTION CONTROL LIDAR

Moscow SOVETSKAYA ROSSIYA in Russian 16 Dec 84 p 2

[Text] Tomsk--A station for high-altitude sounding of the atmosphere began
monitoring the purity of the air over Tomsk yesterday. Data on the distribu-
tion of industrial emissions in the atmosphere are obtained here with the
aid of a multipurpose laser locator, or lidar, which is equipped with a large
receiving mirror. Subsequent processing of the data makes it possible to
determine sources of pollution.

Specialists of the Institute of Atmospheric Optics of the USSR Academy of
Sciences' Siberian Branch taught the laser its new occupation. The laser
beam proved to be capable of obtaining information on the condition of every
layer of air, including the stratosphere. A special computer-based unit of
the station makes it possible to read this information in a matter of seconds.
No measuring method had such accuracy and operational efficiency in the 'pre-
lidar' era.

Within the framework of a Soviet-Bulgarian research program, industry of the
People's Republic of Bulgaria has begun the series production of a laser
complex, the "Elektronika-01", which is based on the Tomsk lidar.

FTD/SNAP
CSO: 1862/181

UDC 621.378.325

INVESTIGATION OF INFLUENCE OF GAS EXIT MODES ON CHARACTERISTICS OF
N_2O - N_2 -He GAS DISCHARGE LASER

TESTOV, V.G., KONEV, Yu.V., MENENKOV, V.D., GRIN', Yu.I. and MISHIN, G.I.,
Radio Engineering and Electronics Institute, USSR Academy of Sciences.

[Abstract] An N_2O laser is investigated in order to determine the
influence of the composition, initial conditions, droplet parameters and
supersonic 1-dimensional flow modes. The variations in the gain in a
rectangular channel of an N_2O - N_2 -He GDL are calculated. The amplifying
properties are measured experimentally as a function of the braking
parameters, the nozzle parameters, the distance from the exit section of
the nozzle and from the axis in the transverse direction and the composition
of the mixture in 3-dimensional and flat jets. The amplifying character-
istics of N_2O - N_2 - He mixtures are analyzed. It is found that amplifica-
tion drops off sharply as the braking parameters increase, due to thermal
dissociation of the working N_2O molecules. Inversion exceeding 10^{15} cm^{-3}
is achieved, which is higher in CO_2 systems; the braking parameters are sig-
nificantly smaller. Comparison of the experimental findings for N_2O - N_2,
N_2O - He and N_2O - N_2 -He mixtures indicate significantly more inversion
for 1-dimensional flow behind a tapered nozzle than for a nozzle with
maximum expansion. Figures 7; references 42: 11 Russian, 31 Western.
[212-6900]

INFLUENCE OF MIRROR ANISOTROPY AND BREWSTER WINDOW ORIENTATION ON RADIATION
CHARACTERISTICS OF RING LASERS

RUBANOV, V.S., SEVERIKOV, V.N. and SHEVTSOVA, A.I., Physics Institute,
Belorussian SSR Academy of Sciences.

[Abstract] The influence of the angle of rotation of the Brewster windows
and the combined phase anisotropy of the cavity on the lasing polarization
and energy characteristics of a ring laser is investigated. The polarization
azimuths and elipticities are investigated in a triangular ring laser
operating at $\lambda = 1.5$ μm. The findings make it possible to assess the
influence of magnetic fields on the frequency characteristics of ring lasers
based on the actual phase anisotropy of the laser mirrors and the orientation
accuracy of the Brewster exit windows of the active element. Figures 2;
references 4: 3 Russian, 1 Western.
[6900-158]

LASING ON LiF:F⁻₂ - DYE CENTERS WITH TRANSVERSE PUMPING

LASING ON LiF:F^-_2 - DYE CENTERS WITH TRANSVERSE PUMPING

KARPUSHKO, F.V. and MOROZOV, V.P.

[Abstract] This study describes tunable lasing in an LiF:F^-_2 - color
center crystal laser employing transverse pumping. Uniform transverse
pumping of the active crystals is achieved by employing banks of 90°
prisms, which satisfy the condition of total internal reflection for the
pumping radiation. A tunable lasing line with 0.6 cm^{-1} and 80 mJ is
achieved in the selective cavity of the device, employing a holographic selec-
tor with spatial frequency of 2100 mm^{-1} as the dispersing element. The
pumping scheme can, in principle, be used to obtain powerful tunable
lasing in organic dye solutions without using amplifier stages. References:
5 Russian.
[140-6900]

UDC 541.141.144

PARTICIPATION OF SINGLET OXYGEN IN PHOTODESTRUCTION OF AIR-SATURATED SOLUTIONS
OF COUMARIN DYES

ZIN'KOVSKAYA, O.V., KUZNESTOVA, N.A. and KALIYA, O.L.

[Abstract] The photolysis of laser coumarin dyes in air-saturated solutions
is investigated in order to provide an explanation of the mechanism
underlying photooxidation. Coumarin-47, -120, -7 and -30 with no additional
purification were employed, with ethanol, benzine, acetonitryl and carbon
tetrachloride solvents. The dye solutions were irradiated with light at
365 nm extracted from the spectrum of a lamp by means of glass light filters.
The role of singlet oxygen in the photooxidation of courmarins is confirmed
by the relationship determined between the efficiency of the process and
the nature of the solvent. This conclusion agrees with other findings
employing a different oxygen singlet absorber to stabilize a coumarin-47
based active laser medium. Figures 4; references 15: 9 Russian, 6 Western.
[140-6900]

UDC 551.508.9

THE POSSIBILITIES OF REMOTE ANALYSIS OF ATMOSPHERIC GASES BASED ON RAMAN
SCATTERING SPECTROSCOPY

GLAZOV, G.N. and DANICHKIN, S.A.

[Abstract] This study investigates the possibility of employing ground-based
Raman-scattering lidars to investigate the molecular gas concentration pro-
file of the atmosphere. The random error of the method is analyzed; the
efficiency of existing Raman scattering lidars is investigated, and the
gas-analytic capabilities of lidars employing excimer lasers are studied
using hypothetical systems with optimum sounding wavelengths as an example.
It is found that UV band excimer lasers expand the capabilities of Raman
scattering lidars significantly, and make them highly promising for numerous
remote (up to 1 to 2 km altitude) atmospheric gas analysis tasks.
Figures 2; tables 3; references 16: 9 Russian, 7 Western.
[140-6900]

UDC 621.378.3

CHOICE OF OPTIMUM SATURATING ABSORBER FOR YAG PASSIVE MODE-LOCKING LASER

DEMCHUK, M.I., MIKHAYLOV, V.P. and YUMASHEV, K.V.

/Abstract/ This study describes investigations conducted to develop
optimization criteria for passive mode-locking in YAG lasers. More than
90 passive shutters based on saturating absorbers with polymethine dyes in
the liquid and solid phases, as well as alkali-halide crystals with Z-
centers, are investigated. The findings make it possible to assess the
limiting capabilities of passive mode-locking YAG lasers for existing
saturating absorber components, and to provide practical recommendations
for the synthesis of new absorber components which provide the required set
of laser parameters. A group of dyes is identified which provide the
maximum energy and minimum ultra-short pulse length: these are dyes number
2681u in solution and film, number 7029, analogs of dye number 3955 contain-
ing ClO^-_4 and $F_3DSO^-_3$ anions, as well as an analog of dye number 1000 with
a BF^-_4 anion. The findings agree with the theory of passive mode-locking
of solid state lasers. References: 11 Russian.
/140-6900/

UDC 535.853

IN-CAVITY LASER IR SPECTRUM ANALYZER FOR INVESTIGATING NON-STEADY-STATE
PROCESSES

VRATSKIY, V.A. and KOLEROV, A.N.

/Abstract/ An $LiF:F^+_2$ in-cavity IR spectrum analyzer is developed which
provides sensitivity of approximately 5×10^{-9} cm^{-1} operating in the 870 -
1000 nm band. More than 200 new absorption lines are observed for atmos-
pheric air, as well as a large number of highly excited transitions in the
925 - 960 nm band. The large number of absorption lines for atmospheric air
results from weak transitions of water vapor, hydrocarbons and cyanogen
compounds. The excited transition lines are caused by the occurrence of
ionization products, as well as short-lived compounds formed through plasma
chemical reactions. The characteristic variations in spectral intensity and
form of the absorption line are determined. A method and instrumentation
are developed for studying the dynamics of absorption (or emission) spectra
that can be employed to investigate non-steady state high-speed phenomena in
pulse plasma, explosion processes and the combustion of various flames, as
well as to investigate the properties of intermediate products in plasma
chemical reactions. Figures 4; references 3 Russian.
/140-6900/

OPERATION OF SOLID STATE LASERS EXPOSED TO ELECTRON BEAM

BEDILOV, M.R., BEYSEMBAYEVA, Kh.B., KHABIBULLAYEV, P.K. and SAIDOV, R.P., Nuclear Physics Institute, Uzbek SSR Academy of Sciences.

[Abstract] This study presents the basic findings from an investigation of the influence of the beam of electrons arising during the operation of a laser thermonuclear reactor on the characteristics of stimulated emission. The experiments were conducted with ruby, YAG:Nd^{3+} garnet and various types of glass lasers. The temporal, energy and spectral characteristics are investigated for specimens of these materials irradiated by an electron beam with density of $10^{12} - 10^{14}$ el/cm^2. It is found experimentally that the degradation in the characteristics of the stimulated emission of a laser within the field of an electron beam is explained by defects formed in the active element, and by other factors as well. For example, defects are found in the substrates of the reflecting mirrors, which also degrade the performance. Contributing factors include the occurrence of color centers which absorb the exciting photon, reduced concentration of the active Cr^{3+} ion, and the occurrence of defects absorbed in the lasing region. The findings are significant for the development of efficient laser thermonuclear reactors and radiation-resistant solid state lasers. Figures 5; references 13 Russian. [148-6900]

ESTABLISHMENT OF STEADY-STATE POWER LEVEL IN PULSE-PERIODIC EXCIMER LASER

BORISOV, V.M., VYSIKAYLO, F.I., VINOKHODOV, A.Yu. and KIRYUKHIN, Yu.B.

[Abstract] This study investigates the characteristic time (or number of pulses) required for the lasing energy of a pulse-periodic excimer laser to drop from the monopulse energy level to the steady-state value for a given pulse reposition frequency. The experiments were performed on a pulse-periodic excimer laser with frequency variable from about 1 to 10^3 Hz. It is found that the pulse lasing energy drops to the defined value within 10 - 20 pulses, and is determined by a number of factors. An interpretation is provided for the dynamics of the change in the lasing energy from pulse to pulse. The behavior observed is explained by the occurrence of acoustic waves in the loop, and the manner in which these waves interact with one another. Figures 4; references 5: 4 Russian, 1 Western. [148-6900]

UDC 535.8:621.374.4

THE PROBLEM OF BRIGHTNESS ENHANCEMENT DURING LASER FREQUENCY DOUBLING

AVERBAKH, V.S., MAKAROV, A.I. and POTEMKIN, A.K., Applied Physics Institute, USSR Academy of Sciences, Gorkiy.

[Abstract] The characteristics of the transformation of the spatial structure of powerful laser system beams when their frequencies are doubled in nonlinear crystals are investigated qualitatively. The aim is to derive a condition on the wavefront of the initial beam which must be satisfied in order to increase the brightness of second-harmonic radiation. The analysis is based on wave equations written in parabolic approximation for slowly-fluctuating amplitudes of the interacting waves propagating in the direction of synchronism in the crystal. It is found that the change in brightness is determined by the ratio of the geometric component (characteristic angles) of the beam divergence to the diffraction component at the crystal input. An unchanged radiation brightness, and a 3.5-fold brightness enhancement are demonstrated experimentally as a function of the curvature of the wavefront for 88% power conversion in a KDP crystal with harmonic laser radiation of $B=5\times10^{17}w/cm^2$. Brightness enhancement is also observed in a KDP crystal cut for type-II synchronism (L = 2.5 cm). It is found that depolarization of no more than 0.3% is required in order to obtain near-maximum brightness. Figures 5; references 10: 7 Russian, 3 Western.
[148-6900]

UDC 621.373.826

LASER RADIATION PROPAGATION IN INERTIALESS NONLINEAR MEDIUM

GOCHELASHVILI, K.S., CHASHEY, I.V. and SHISHOV, V.I., General Physics Institute, USSR Academy of Sciences; Physics Institute imeni P.N. Lebedev, USSR Academy of Sciences.

[Abstract] The propagation of laser radiation in a nonlinear medium with smaller than average variations in the index of refraction is investigated. An equation is derived for the second-order coherence function for propagation over long distances, where a saturated fluctuation condition replaces exponential growth in perturbations in the wave. The equation is analyzed on the basis of a self-similar solution. Similar results are found to hold for a turbulent nonlinear medium as well. References 14: 11 Russian, 3 Western.
[148-6900]

UDC 621.383.8.038.824

DYNAMICS OF EMISSION FROM DYE LASERS EMPLOYING SYNCHRONOUS PUMPING BY
LIMITED PICOSECOND PULSE TRAIN

KOVRIGIN, A.I., NEKHAYENKO, V.A., PERSHIN, S.M. and PODSHIVALOV, A.A., Moscow
State University imeni M.V. Lomonosov.

/Abstract/ Synchronous pulsed emission of organic dye lasers pumped by a
train of picosecond pulses from a mode-locked laser is examined theoretically
and experimentally. A model is developed for the production of supershort
light pulses. A four-level model of the active medium is employed, making it
possible to investigate the mode-locking kinetics and to calculate the limit-
ing emission parameters. Because the synchronous emission process is
unsteady, it is found that the parameters in the pulse train change signi-
ficantly, and that there is no complete time correlation between an emitted
pulse and its corresponding pumping pulse. It is recommended that trains
containing more than thirty pulses be employed in order to obtain synchron-
ously tracking pulses with minimum duration, and that the length of the dye
laser cavity be adjusted to obtain the maximum second-harmonic radiation
energy in order to produce the shortest possible pulses. The experimental
findings agree well with the theory; the minimum spectrally-limited pulse
length achieved is 8 ps. Figures 10; references 30: 7 Russian, 2 Western,
1 Japanese.
/148-690/

UDC 621.373:826.038.84

HIGH-POWER TWO-FREQUENCY CW DYE LASER

BALYKIN, V.I. and SIDOROV, A.I., Spectroscopy Institute, USSR Academy of
Sciences.

/Abstract/ Stable two-frequency continuous-wave high-power (exceeding 1W)
lasing in a dye laser pumped by an argon laser with assigned frequency dis-
tance between the modes is described. Two-frequency lasing is achieved by
employing spatial inversion combustion in linear-cavity lasers. The layout
of the two-frequency laser system, which is pumped by a Spectra Physics
Model M171 Ar^+ laser, is described. Maximum output power of 1.23W is
achieved while maintaining a stable lasing spectrum. The efficiency of the
two-frequency dye laser was 14.3%, which is close to that of a single-mode
ring laser. The fluctuation of the frequency distance between the two modes
and the width of each axial mode did not exceed 10 MHz. The optical circuit

of the cavity employs selective elements with non-sputtered surfaces.
Figures 5; references 13: 5 Russian, 8 Western.
/148-690_7

SATURATION EFFECT IN MULTILEVEL LASING MEDIA

L'VOV, V.I., STEPANOV, A.A. and SHCHEGLOV, V.A., Physics Institute imeni
P.N. Lebedev, USSR Academy of Sciences.

[Abstract] An approach is developed for describing the saturation effect
during the resonant interaction of multifrequency radiation with an active
medium. The effectiveness of the approach is demonstrated by the example of
multilevel media with parallel and cascade transitions. The energy concep-
tion of the saturation effect, upon which the approach is based, is explained
briefly. The statement of the problem is shown to be unambiguous for
specific conditions determining the required amplification mode, as well as
the spectral composition of the external radiation. Figures 4; references:
6 Russian.
/148-690_7

OPTICAL INHOMOGENEITIES IN A NANOSECOND-PULSE IODINE PHOTODISSOCIATION LASER
WITH SLOW UV RADIATION PUMPING

SKALA, I., KHVOYKA, M., PEKAREK, L., KRALIKOVA, B., ZUYEV, V.S., KOROL'KOV,
K.S. and ORLOV, Ye. P., Physics Institute, Czechoslovakian Academy of
Sciences; Physics Institute imeni P.N. Lebedev, USSR Academy of Sciences.

[Abstract] This study investigates the evolution of the gradient profile
of the index of refraction of the active medium of a nanosecond-pulse
iodine laser. An experimental setup incorporating a helium-neon laser and
a quartz glass cuvette is described. This system was used to measure the
temporal behavior of the deviations of the rays in the beam. The refraction
index gradient profile is found to be comprised of two components: a
slow one which increases monotonically over time, and a rapidly fluctuating
one associated with the formation of standing acoustic waves. It is demon-
strated that only the first cylindrical oscillating mode is excited, and
that the harmful influence of acoustic oscillations can be avoided by

amplifying the pulse when the refraction of the aspherical lens becomes zero. It is found by comparison with the experimental findings that the monotonic component of the profile results from radial pumping inhomogeneity. It is found that good beam directivity can be achieved in the type of laser investigated, but that the diameter and output energy are limited by the inversion time and the speed of sound. Figures 4; references 9: 5 Russian, 1 Czech, 3 Western.
/148-690/

UDC 621.378.325:546.314

EXCIMER-LASER GENERATOR OF POWERFUL UV PICOSECOND PULSES SYNCHRONIZED WITH PICOSECOND PULSES IN VISIBLE AND IR BANDS

AKHMANOV, S.A., VAL'SHIN, A.M., GORDIYENKO, V.M., DZHIDZHOYEV, M.S., KRAYUSHKIN, S.V., PLATONENKO, V.T. and POPOV, V.K., Moscow State University imeni M.V. Lomonosov.

/Abstract/ This study describes an XeCl excimer-laser based oscillator which produces powerful ultrashort UV pulses with durations of approximately 30 ns and energy of approximately 10 mJ at $\lambda = 0.308$ μm. The master oscillator is a $YAlO_3:Nd^{3+}$ yttrium aluminate passive mode-locked laser. A train of picosecond pulses from this device is used to drive a CDA-crystal-harmonic generator ($\lambda = 0.53$ μm). Second-harmonic radiation from this stage drives a C160 dye laser ($\lambda = 616$ nm), and the XeCl excimer oscillator then amplifies the second-harmonic of the C160 output. The system can be used for experiments on picosecond UV photolysis incorporating picosecond recording of products by active spectroscopy, as well as for investigating laser annealing processes, etc. Figures 1; references 10: 6 Russian, 4 Western.
/148-690/

UDC 621.373.826.038.824

POSSIBILITY OF MEASUREMENT OF SMALL DISPLACEMENTS BY RING LASER

BELENOV, E.M., DANILEYKO, M.V. and USKOV, A.V., Physics Institute imeni P.N. Lebedev, USSR Academy of Sciences.

/Abstract/ A method for measuring small displacements based on the dynamics of a ring laser is proposed. The system incorporates a ring laser in which

waves propagate in opposite directions. The first wave exits the laser and is then returned to the ring cavity by mirrors; if the mirrors are removed, the two waves will be synchronized even when the ring cavity is slightly non-reciprocal; the photodetector current is also constant. The re-entry of the first wave into the ring cavity and oscillation of the mirror causes the phase difference to fluctuate. The signal at the output of the photo-detector is then proportional to the amplitude recorded by the synchronous detector. The characteristics of the proposed method are compared with those of other laser methods. It is found that the minimum detected amplitude can be reduced by the proposed system by a factor of four, down to 10^{-18} to 10^{-19} cm. The proposed system contains no absorbing cells, and is significantly smaller than other laser systems. References: 5 Russian. [148-6900]

INFRARED LASER HOLOGRAPHY USED IN FUSION PLASMA STUDIES

Riga SOVETSKAYA LATVIYA, Mar 85 p 4

/Text/ Tbilisi -- A method of producing holographic images using invisible infrared rays has been proposed at the Georgian Academy of Sciences' Institute of Physics. It makes it possible not only to reproduce the object being depicted in three dimensions, but also literally to see through it. This makes it possible to detect in an object various internal impurities and flaws which are undetectable by other means.

The transparent hologram is produced by means of an instantaneous flash of a powerful infrared laser, which is widely used in the welding and cutting of metals. The image is recorded on polymethyl methacrylate or transparent cellulose film.

"Infrared holography is also a good tool for the study of plasma as it is heated by laser radiation," related Professor N. Tsintsadze, the project director. "Such plasma exists for only several millionths of a second. The accuracy of the measurements increases sharply in comparison with that of other methods. Such experiments are being conducted as part of the large-scale research program on controlled thermonuclear fusion."

Infrared holography also holds promise for optics, and for inspecting the purity of materials in semiconductor technology.

FTD/SNAP
CSO: 1862/316

TUNABLE LASERS WITH HIGH CONVERSION EFFICIENCY

Moscow MOSKOVSKAYA PRAVDA, 7 Mar 85, No 56 (19776), p 1, cols. 5-6

/Text7 Tashkent -- Work by scientists of the Uzbek Academy of Sciences'
Institute of Electronics is opening up new prospects for the utilization of
laser technology. These scientists have succeeded in raising the smooth
conversion efficiency of laser radiation to 75 percent. This is almost five
times as high as the characteristics that were previously achieved. Quantum
oscillators that are tunable over a wide range of the spectrum are finding
use in spectroscopy, holography, chemistry, biology, and in the development
of flexible laser systems.

FTD/SNAP
CSO: 1862/316

UDC 621.378.325

SELF Q-MODULATION AND GENERATION OF SHORT PULSES IN DISTRIBUTED-FEEDBACK
LASERS

KARAMALIYEV, R.A. and DAO SUAN KHAY, Azerbaijan State University imeni
S.M. Kirov.

[Abstract] The characteristics of the oscillatory mode of distributed-
feedback dye lasers forming an optically-induced periodic gain structure are
investigated. It is found analytically that short pulses in distributed-
feedback lasers result from self-modulation of the Q-factor or the molecular
loss coefficient. Distributed-feedback dye lasers are found to produce light
pulses several tens of picoseconds long. References 4: 2 Russian,
2 Western.
[45-6900]

LOW-THRESHOLD INJECTION InGaAsP/GaAs DOUBLE HETEROSTRUCTURE LASERS WITH
SEPARATE LIMITING OBTAINED BY LIQUID-PHASE EPITAXY (λ = 0.78 $\div$ 0.87 μm,
I_{thr}=460 A/cm^2, T=300 K)

ALFËROV, Zh.I., ARSENT'EV, I.N., VAVILOVA, L.S., GARBUZOV, D.Z. and
KRASOVSKIY, V.V., Physical-Technical Institute imeni A.F. Ioffe, USSR Academy
of Sciences.

[Abstract] Low-threshold infared and red separate-limited double hetero-
structure lasers based on InGaAsP/GaAs structures with active region thickness
d $\ll$ d_o=0.1+0.03 μm, prepared by ordinary liquid-phase epitaxy, are des-
cribed. The devices employ additional waveguide layers of InGaAsP between
the narrow-zone active region and the wide-zone emitters. The active region
is $2 \cdot 10^{-6}$ μm thick, with the total thickness of the waveguide lasers
comprising 0.4 μm. A minimum threshold of 460 A/cm^2 (T = 300 K) is ob-
tained for four-layer specimens. Continuous lasing is obtained at room

temperature in lasers not employing strip designs. The drop in thresholds in double heterostructure lasers with separate limiting is interpreted as resulting from the fact that the absolute threshold current densities continue to drop as d becomes smaller in the region $d < d_0$, in spite of the near-linear drop in $\Gamma = f(d)$. Figures 2; references 11: 8 Russian, 3 Western. /112-6900/

UDC 537.521.7

SPACE-TIME CHARACTERISTICS OF FIELD IN LONGITUDINAL PULSE-PERIOD DISCHARGE TYPICAL IN PUMPING OF SELF-TERMINATING LASERS

KUKHAREV, V.N., Optika Special Design Bureau for Scientific Instrumentation, Siberian Department, USSR Academy of Sciences

/Abstract/ Experimental findings on determining the field behavior in a pulse-periodic discharge with high repetition frequencies are presented. The spatial distribution of the potential in the plasma of a longitudinal pulse-periodic discharge, and the behavior of that distribution over the entire gas-discharge pulse, are investigated. It is found experimentally that the pulse discharge process at high repetition frequencies can be divided into three stages: during the first, the plasma column is polarized, which is followed by the transmission of 'recharging' ionization waves, causing an alternate rise and fall in the voltage near the electrodes. The third stage is characterized by a practically linear potential distribution in the plasma column. The relationship between the features of the pulse-periodic discharge employed in pumping self-terminating lasers and the operating characteristics of such lasers are discussed. The formation of the pulse structure in copper-vapor lasers (λ = 510.6nm, λ_2 = 578 ' 2 nm) is analyzed as an example. Figures 3; references: 10 Russian. /111-6900/

UDC 621.383

INFLUENCE OF TECHNOLOGICAL FACTORS ON LUMINESCENCE CHARACTERISTICS OF InGaAsP/InP HETEROLASERS (λ = 1.55 μm)

GORELENOK, A.T., GRUZDOV, V.G. and TARASOV, I.S., Physical-Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences.

/Abstract/ The influence of lattice parameter mismatch and the thicknesses of the intermediate layer and active region on the threshold current density,

differential quantum efficiency and quantum radiation yield characteristics
of InGaAsP/InP double heterostructure lasers are investigated. The lasers
were created by liquid-phase epitaxy on substrates of n-InP:Sn with (100)
orientation in a step-cooling process. The use of intermediate layers to
prevent acceptors from entering the active region made it possible to
reduce the threshold current density at 1.5 μm to approximately 1 kA/cm^2,
and to achieve threshold current densities of 4 - 4.5 kA/cm^2. Figures 2;
references 16: 14 Russian, 2 Western.
/111-6900/

POWERFUL XeCl EXCIMER ELECTRIC DISCHARGE LASER WITH GOOD TEMPORAL STABILITY
AND FAST RESPONSE TIME

DZHIDZHOYEV, M.S., PLATONENKO, V.T. and POPOV, V.K., Department of
General Physics and Wave Processes

/Abstract/ An XeCl excimer laser producing approximately 300 mJ with a
pulse length of approximately 15 ns, operating time of 100 ns and temporal
stability exceeding +3 ns is described. The pulse energy was measured by
means of a calorimeter with galvanometer: at 3 atm, the maximum lasing energy
for an HCl:Xa:Ha laser employing proportions of 3:30:2250 was 0.3 J with
a pulse length of 15 ns. Because of its good temporal stability and
fast response time, the system can be employed in conjunction with various
laser devices, including passive mode-locked YAG:Nd^{3+} lasers.   Figures 2;
references 7: 1 Russian, 6 Western.
/104-6900/

SPECTRAL-LUMINESCENCE CHARACTERISTICS AND INDUCED EMISSION OF Nd^{3+} ION IN
$Gd_{2-x}Nd_x(WO_4)_3$ CRYSTALS

BERENBERG, V.A., IVANOV, A.O. (deceased), KRUTOVA, L.I., MOCHALOV, I.V.
and TERPUGOV, V.S.

/Abstract/ Highly concentrated $Gd_{2-x}Nd_x(WO_4)_3$ crystals obtained by the
Chokhral'skiy method on a Donets-3 commercial system are investigated.
Spectroscopic measurements to determine the Stark levels and to identify
transitions between levels were conducted by traditional absorption and

luminescence analysis methods. The findings indicate that gadolinium-neodymium tungstate crystals can be used effectively in solid state microlasers pumped by light pulses with durations of a few microseconds. Figures 3; references 9: 6 Russian, 3 Western.
/108-690/

STUDIES IN LASER OPTICS AT ARMENIAN PHYSICAL RESEARCH INSTITUTE

Yerevan KOMMUNIST in Russian 18 Sep 84 p 1

[Article by M. Ter-Mikayelyan, director of the Institute of Physical Research, ArSSR Academy of Sciences, academician of ArSSR Academy of Sciences: "With the Aid of Lasers"]

[Text] It would be a hard job any more to find a field of human endeavor that does not make use of the advances in laser engineering based on the pioneering work of academicians N. G. Basov and A. M. Prokhorov. One such field is nonlinear optics, which investigates the nonlinear properties of matter when optical radiation passes through it.

The great bulk of experiments on nonlinear optics involves the use of lasers: sources of narrowly directed intense optical radiation of a definite color. Therefore the creation of lasers is a primary task in the development of research on nonlinear optics.

As far back as the sixties, the first ruby lasers were made in our republic and displayed at the Leipzig Fair; these lasers formed the basis for development of laser technology and nonlinear optics in Armenia. Now we have a number of centers that are developing and using laser technology in a variety of sectors of scientific research, in engineering, and in industry.

Ruby and garnet industrial lasers have been produced and perfected by joint efforts of the Institute of Physical Research and Kristall Production Association. The State Prize of the Armenian SSR has been awarded to a research team for this work.

A special instrument for measuring the duration of ultrashort pulses to determine the range of meteorological visibility has been developed in our laboratories in cooperation with Hungarian scientists.

Institute scientists have directed their efforts toward the conquest of new ranges in developing sources of laser emission. Lasers have already been developed and put into operation in different regions of the infrared band. Some original research on nonlinear optics has been organized. Scientists have concentrated their attention on studying the interaction of laser radiation with gaseous media, i. e., with the simplest atomic systems.

Stimulated electronic Raman scattering was first experimentally observed by scientists of our institute contemporaneously with U. S. researchers. This marked the inception of a great deal of theoretical and experimental research in our nation.

Intensive research is in progress right now on developing a new type of frequency converter based on so-called resonant interactions of radiation with atoms. This is bringing about new capabilities for production of special instruments and for doing research on nonlinear optics.

6610
CSO: 1862/56

UDC 621.382.3

ADJUSTMENT OF RADIATION WAVELENGTH OF MULTIMODE InP-GaInAsP INJECTION
HETEROLASERS

KIRSON, Ya.E., KLOTYN'SH, E.E. and CHURKSTE, I.A., Physical-Power
Engineering Institute, Latvian SSR Academy of Sciences.

/Abstract/ The spectral tuning of injection lasers is investigated on the
basis of a forbidden InP-GaInAsP mesastrip structure operating in the con-
tinuous mode at room temperature. In order to avoid heating of the active
region when the pumping current changes, the laser was driven by 50-ns
rectangular pulses at 2 MHz. Spectral recordings revealed that five mode
'jumps' occur as the temperature increases from 0 to 45° C. The behavior
of these modes is analyzed; it is found that the jumps are caused by heat-
induced changes in the parameters of the optical cavity. Increasing the
pumping current beyond the threshold level also causes mode transfer, as the
result of which the power-averaged wavelength increases while the wavelength
of the individual modes remains unchanged, at least for pumping current
smaller than $2.5I_{thr}$. References: 4 Russian.
/126-6900/

SELECTIVE POPULATION OF n = 3 OVIII LEVEL DURING EXPANSION OF LASER PLASMA
IN HELIUM

ZHUKOV, S.P., KORUKHOV, V.V., TROSHIN, B.I. and CHERNENKO, A.A., Thermal
Physics Institute, Siberian Department, USSR Academy of Sciences.

/Abstract/ The mechanism underlying the formation of inverse population of
levels of multiply-charged ions on the basis of recharging is realized
experimentally for the first time. The experimental setup consisted of a

neodymium glass laser, a vacuum chamber and a X-ray spectrograph. The experiments were conducted with spatial resolution along the plasma flame, using a pulse length of approximately 0.5 ns. It is found experimentally that when a laser plasma flame containing multiply-charged oxygen ions expands, the OVIII oxygen levels become selectively populated due to recharging of the oxygen nucleii on helium ions. Figures 2; references 7: 4 Russian, 3 Western.
/131-6900/

PASSIVE Q-MODULATION OF OPTICAL CAVITIES BY KCl CRYSTALS CONTAINING OH⁻ -IONS

SOBOLEV, L.M., BRYUKVIN, V.V., PARFIANOVICH, I.A. and PENZINA, E.E.

/Abstract/ The investigation of color centers in KCl-OH crystals additively colored in potassium vapors is described. It is found that irradiation of colored crystals by white light results in the formation of a series of F-aggregate color centers which are stable at room temperature. The use of such crystals as passive laser shutters to Q-modulate the cavity of a YAG-Nd^{3+} laser (1.064 μm) is described. It is found that working color centers that are thermally and optically stable at room temperature can be obtained by additive coloration of hydroxyl-doped KCl crystals in alkali metal vapors followed by exposure to light. Similar centers are unstable at room temperature if the KCl crystals contain no OH⁻ -ions, and cannot be used as passive shutters. An interpretation is given of the mechanism underlying the stabilization of working centers. References 7: 5 Russian, 2 Western.
/146-6900/

MECHANICS OF SOLIDS

UDC 534.26:539.3

ACOUSTIC WAVE SCATTERING BY ROUND CYLINDRICAL SHELL REINFORCED WITH STRINGERS

PODDUBNYAK, A.P. and VOLOSHIN, A.R., Applied Problems of Mechanics and Mathematics Institute, Ukrainian SSR Academy of Sciences, L'vov.

/Abstract/ The influence of elastic ribs within a thin cylindrical shell submerged in liquid on the echo-signal structure is investigated. An elastic infinitely long round cylindrical shell stiffened internally by a regular system of stringers is struck by a plane pressure wave with its front parallel to the axis of the scatterer. Boundary conditions are assigned on the interface surface between the liquid and the elastic system (assuming the shell to contain a vacuum). The problem is solved in two stages: the scattering of sound by a shell within ribs is investigated, and then the wave field generated by oscillations of a ribbed shell is found. The scattered wave is found to consist of waves that are reflected and re-radiated by the shell envelope itself with no influence from the reinforcing ribs, and three types of waves radiated by the shell under the influence of tangential and normal shifts, as well as rotation caused by interaction between the envelope and the ribs at the points of contact. If the shell thickness is set equal to zero, the problem becomes one of scattering of acoustic waves by a regular lattice of elastic ribs contained an acoustically soft round cylindrical shield. References 5 Russian.
[132-6900]

MOLECULAR PHYSICS

UDC 539.194+621.373:535

IDENTIFICATION OF VIBRATIONAL-ROTATIONAL TRANSITIONS OF $^{192}OsO_4$ WITHIN FREQUENCY TUNING LIMITS OF HIGH PRESSURE CO_2 WAVEGUIDE LASER

BAZAROV, Ye.N., GERASIMOV, G.A., GUBIN, V.P., DERBOV, V.L., NOVIKOV, A.D., OTROKHOV, S.Yu., SAZONOV, A.I. and FOMIN, V.U.

[Abstract] The transitions of the $^{192}OsO_4$ molecule - the most common isotype modification of osmium tetroxide - are observed and identified; a set of molecular constants to describe these transitions within the framework of the Moret-Bially formalism is obtained. On the basis of preliminary calculation of the frequencies and intensities, the strongest lines are related to permitted transitions of the primary band ν_3. The tuning band of the laser employed covered 1.5 GHz. Transitions of the P- and R- branches of the ν_3 band of $^{192}OsO_4$ at values of J exceeding 100 are observed in this range of lines. The spectra were observed and photographed from the screen of an oscilloscope swept in sync with the voltage applied to the piezoceramic of the laser. The absorption spectra of $^{192}OsO_4$ on the CO_2 P14 and R16 lasing lines presented as an example. Figures 1; references 19: 7 Russian, 12 Western.
[108-6900]

UDC 535

TOWARD A THEORY OF EXCITATION OF ATOMS DURING NUCLEAR AND MAGNETIC NEUTRON SCATTERING

YUDIN, G.L.

[Abstract] A theory of atom excitation is proposed which combines the 'nuclear' and 'atomic' parts of the problem and makes it possible to find directly the atom excitation and ionization cross section in collisions

with neutrons. The single-electron problem is examined in general form, and can be extended to the case of several electrons with allowance for suppression of magnetic scattering without difficulty. Magnetic neutron scattering on magnetoactive electrons is taken into account, as well as nuclear scattering caused by interaction between neutrons and nuclei. References 5: 4 Russian, 1 Western.
/137-6900/

NONEQUILIBRIUM KINETICS OF GROWTH OF OXIDE LAYER GRAINS DURING LASER HEATING OF METALS IN AIR

ALIMOV, D. T., BOBYREV, V. A., BUNKIN, F. V., corresponding member, USSR Academy of Sciences, ZHURAVSKIY, V. L., LUK'YANCHUK, V. S., MOROZOVA, Ye. A., UBAYDULLAYEV, S. A. and KHABIBULLAYEV, P. K., Institute of General Physics, USSR Academy of Sciences.

/Abstract/ The growth kinetics of the grains of the oxide layer formed during laser heating of metals in air are investigated. Continuous radiation from a CO_2 laser was focused on the surface of a cobalt target. After the laser was turned off, the target surface was photographed by an electron microscope, revealing clearly the grain structure of the oxide layer. Similar experiments were conducted during isothermic oxidation of the target in an electric furnace. The grains were found to be uniformly large under the isothermic conditions; for laser heating, the trains were enlarged "on the average", and a drop in the distribution function was observed, resulting from the formation of ensembles of "small" and "large" particles. This phenomenon was observed for cobalt, as well as other metals, especially copper. An analysis of the phenomena indicates that if the initial size distribution of the grains is smooth enough, which is the case for equilibrium processes, the distribution function of the grains by dimensions will remain sufficiently smooth as the evolution continues. If the initial distribution is sufficiently "sharp", which is the case for highly nonequilibrium processes, it is possible for several ensembles of particles with different dimensions to form as the distribution evolves. Figures 3, references: 3 Russian.
/171-6900/

RADIATIVE-COLLISION GENERATION OF SOUND IN GASES SUBJECTED TO SINGLE-PULSE OPTICAL EXCITATION

SHALAYEV, V.M. and YAKHNIN, V.Z., Physics Institute, Siberian Department,
USSR Academy of Sciences.

[Abstract] The phenomenon of radiative-collision generation of sound caused
by light-induced drift of gases subjected to single-pulse optical excita-
tion is analyzed theoretically. The spectral characteristics of the
acoustic signal resulting from light-induced drift, and their relationship
with the parameters of the medium and the radiation, are analyzed. Two
mechanisms are found to underlie the generation of sound by light-induced
drift: selective and diffusive. A necessary and sufficient condition for
the development of a diffusive current of excited particles is that the
intensity gradient of the inducing radiation be nonzero. The calculations
provide the theoretical basis for a method for determining the transport
scattering cross-sections of excited atoms and molecules from experimental
data on the acoustic signal resulting from light-induced drift in the field
of a single light pulse. The findings are applicable to laser acoustic
sources as well. References 22: 18 Russian, 4 Western.
[123-6900]

DOPPLER SPECTROMETER FOR MEASURING NARROW PHOTOCHEMICAL GAPS IN INHOMO-
GENEOUSLY BROADENED SPECTRA

REBANE, K.K. and PAL'M, V., Physics Institute, Estonian SSR Academy of
Sciences.

[Abstract] A method is proposed for measuring the contours of narrow
photochemical gaps in spectra by using the Doppler frequency shift of the
broadened lasing line. An experimental setup is described that incorporates
a single-frequency CR-699-21 CW Rh6G dye laser with a Doppler modulator that
broadens the line by approximately $0.005 \Delta V$. A spectrally narrow gap is
formed in the absorption spectrum of the object by exposing it to the beam
from a monochromatic laser with frequency V_0, line width of δ_L ($\delta_L \ll \delta$
10^{-2} to $10^{-4} cm^{-1}$) and intensity of approximately 10 $\mu W/mm^2$ until the trans-
mission at frequency V_0 increases by a factor of 5 to 10. The photochemical
gap width in the absorption spectrum of H_2-octaethylporphine in a polystyrene
matrix at 1.5K was measured, yielding a half-width of $(17+4) \times 10^{-3} cm^{-1}$.
The Doppler-effect contour measurement method is promising for the measure-
ment of super narrow gaps occurring, for example, in objects with high

optical density. It can also be used with lasers having poor long-term sta-
bility, as well as multimode lasers. Doppler modulation of the frequency
of a laser beam is also of independent interest in highly selective photo-
chemistry and other applications. Figures 2; references: 9 Russian.
/213-6900/

RESONANT ENERGY TRANSFER DURING STRONG EXCITATION

AGABEKYAN, A.S.

/Abstract/ This study examines the kinetics of excitation attenuation and
addresses the possible role of phase relationships in the energy transfer
process in a donor-acceptor pair in which both ions are initially excited,
and there are no processes involving up-conversion of the acceptor radiation
frequency. Coherence of the energy transfer is found to be disturbed by
competition between the energy transfer and ion decay processes. Regardless
of the relationship between the system parameters, only noncoherent energy
transfer can occur in a pair of excited ions which interact resonantly.
Different limiting cases of energy transfer are investigated. References 5:
4 Russian, 1 Western.
/140-6900/

TRANSPARENCY OF WATER IN 186 - 500 nm REGION

ROMANOV, N.P. and SHUKLIN, V.S.

/Abstract/ This study investigates the possibility of obtaining optically
pure water by a process in which single distillation and partial condensation
of the vapor is used, with impurities being carried off by the uncondensed
vapors. The partial condensation method is found to produce water with trans-
parency better than that obtained by other purification methods. The exponen-
tial extinction coefficient is measured spectraphotometrically at 186 - 500
nm for water at $23 \pm 0.5°$ C and found to be $0+0.015 m^{-1}$. The value found
coincides with that resulting from molecular scattering at wavelengths
exceeding 230 nm. It is found that the absorption coefficient for water at
wavelengths shorter than 210 nm is an exponential function of the quantum
energy absorbed. References 15: 9 Russian 6 Western.
/140-6900/

ACTIVATION ANALYSIS OF NATURAL WATER USING NEUTRONS OF VARIOUS ENERGIES

KAMIDOVA, R. and ABDULLAYEV, A.A. (deceased), Institute of Nuclear Physics,
Uzbek SSR Academy of Sciences.

[Abstract] This study investigates the use of activation methods with fast
neutrons and protons for analyzing natural water of various origin. The
induced activity of the radio nuclides formed by cyclotron irradiation of
the specimens was measured by a Ge(Li) detector in conjunction with multi-
channel analyzer. The complete absorption gamma-lines and gamma lines re-
sulting from the summation effect are identified. Analyses of natural water
and investigation of the gamma-spectra of proton-irradiated specimens demon-
strated the prospects of selective analysis methods. Thermal neutron
activation is found to be best for analyzing natural water. Figures 2;
references 7: 6 Russian, 1 Western.
[6900-16]

TRANSFORMATION OF CHARGED PARTICLE BEAMS BY CONCENTRATING ELECTRO-OPTICAL
SYSTEMS

SHPAK, Ye.V. and YAVOR, S.Ya., Physical-Technical Institute imeni
A.F. Ioffe, USSR Academy of Sciences.

[Abstract] Analytical expressions are derived which make it possible to
use the characteristics of the initial phase contour of a given electro-
optical system to fully characterize the crossover produced by the system.
The formulas obtained are analogous to those in electron optics to relate
the positions of the object and its image, as well as linear and angular
magnification. The concentrating systems are investigated by finding the
envelopes of the charged-particle beams and examining the movement of the
representative points of the beam in phase space. The transformation of
charged particle beams by a wide class electrooptical systems, including
systems with a plane curvilinear axial trajectory, is investigated. For-
mulas are derived which determine the connection between the crossover
position at the input and output of the concentrating system, as well as the
angular and linear magnification during crossover-crossover conversion.
Figures 2; references 8: 6 Russian, 2 Western.
[111-6900]

THERMAL CONTRACTION OF CURRENT FLOW THROUGH ELECTRODE TURBULENT BOUNDARY LAYER

NEDOSPASOV, A.V., KHAIT, V.D. and SHEYNDLIN, A.E., Academician, Institute of High Temperatures of the USSR Academy of Sciences

/Abstract/ The critical current at which contraction of the discharge in an MHD generator occurs in the presence of turbulent plasma flow along the electrode (anode) walls as a result of heat balance instability at the walls was calculated analytically as a function of the wall temperature. The peak in the current-voltage characteristic of the boundary layer on the electrode was taken as the point of instability. The resistivity and current were calculated by solving a nonlinear ordinary differential equation governing stationary heat flow in the boundary layer. Elsewhere the plasma was assumed to be in equilibrium. The conductivity was assumed to be an exponential function of the temperature only. Convective heat transfer along the electrode wall was ignored and it was assumed that the temperature of the electrode wall was determined by the balancing of heat flow to the wall from the plasma and the heat flow to the external surface of the wall, which was held constant. The theoretical results agreed well with measurements performed on K-1 and U-02 setups and on a burner with a laminar flow. The results show that the critical current increases rapidly above 2000 K. Figures 1, references 15: 14 Russian, 1 Western.
/242-9638/

MIRROR REFLECTION OF CHARGED PARTICLES FROM AMORPHOUS AND POLYCRYSTALLINE SURFACES

KUMAKHOV, M.A.

/Abstract/ The interaction of a positively charged particle with the surface of a smooth amorphous or polycrystalline film (such as glass) is examined. The potential of the interaction between the particle and the surface of the substance is calculated for the case of glancing incidence, in contrast to the case of tunneling, by taking into consideration the repulsion from atoms throughout the entire depth of the substance. The angles of mirror reflection and, for comparison, the critical tunneling angles in silicon strips, are tabulated. The mirror reflection angles are smaller than the characteristic tunneling angles. Tables 1, references: 1 Russian.
/171-6900/

AN ATTEMPT TO DETECT INDUCED NEUTRON CAPTURE IN LASER RADIATION FIELD

MIRONOV, S.M. and MURADYAN, G.U., Atomic Energy Institute imeni I.V. Kurchatov.

/Abstract/ This study describes an experiment conducted to detect change in the neutron radiative capture cross-section of a ^{139}La nucleus induced by the electromagnetic field produced by laser radiation. The experiments employed a transit-time neutron spectrometer with a base of approximately 10.5 m. The neutron burst frequency was 270 Hz; the cylinder pulse length was 100 nsec, and the accelerated electron current was approximately 1 A. Radiative capture events were recorded on a Romashka 11-section scintillation detector. A cross sectional change of $0.25 + 0.56$ bn was observed for a neodymium laser with intensity of 10^5 W/cm^2, which disagrees by at least an order of magnitude with the predicted figure. It is suggested that the divergence is due to the properties of the medium containing the nucleus, rather than the individual properties of the ion, and that the electromagnetic field causes primarily redistribution of the s- and p-states of the decaying compound nucleus, leaving the probability of its formation practically unchanged. Figures 1; references: 8 Russian.
/191-6900/

NUCLEAR PHYSICS

TOWARD THE QUESTION OF MULTI-QUARK CONFIGURATIONS IN NUCLEII

GARSEVANISHVILI, V.R. and MENTESHASHVILI, Z.R., High Energy Physics Institute,
Tbilisi State University

[Abstract] Deep inelastic scattering of charged leptons on an A nucleus is
investigated. The ratio of the structural functions of different nucleii are
found to deviate from unity, which is explained by scattering on colorless
multi-quark formations in the nucleii. A distinguishing feature of the
model employed is the possibility of the existence in the nucleus of a
superfast quark which carries the entire nuclear impulse in the extremal
situation.   Figures 2; references 14: 7 Russian, 7 Western.
[131-690]

EXOTIC EVENTS OF $\bar{p}p$-COLLIDER: EXCITED QUARK OR EXCITED COLOR BOSON?

GERSHTEYN, S.S., DZHIKIYA, G.V. and PIROGOV, Yu.F., High Energy Physics
Institute.

[Abstract] This study investigates exotic events with large missing trans-
verse momenta (up to 90 GeV/c) observed on the CERN $\bar{p}p$-collider, that
require by their signature and effective cross section the existence of an
object with a mass of about 180 GeV/c^2 generated resonantly from hadron
beam constituents and capable of decay into a Wjet and Zjet. Different
hypotheses about the nature of the new heavy object are advanced; it is
concluded that the object must be generated resonantly in $q(\bar{q})g$ or $q\bar{q}$
collisions. Explanation of the exotic events hence requires either the
existence of excited quarks or excited color bosons. The effective cross
section of the occurrence of the exotic events is assessed on the basis of
the hypothesis of an excited quark, and arguments are advanced in favor of
that hypothesis. Correlations in energy spectra are calculated that provide

experimental evidence on the spin of an excited quark and the structure of its interaction. Possible experiments for verifying the hypothesis of an excited quark, as well as alternative hypotheses, are discussed. Figures 8; tables 2; references 17: 1 Russian, 16 Western.
/191-6900/

THE POSSIBILITY OF OBSERVING AND EXPLOITING THE GENERATION OF HIGH-ENERGY PHOTONS BY ELECTRONS IN THE FIELD OF AN INTENSE ELECTROMAGNETIC WAVE

GINZBURG, I.F., KOTKIN, G.L. and POLITYKO, S.I., Mathematics Institute, Siberian Department, USSR Academy of Sciences.

/Abstract/ The generation of high-energy photons by electrons at the focal point of a laser beam is investigated. The electron generation of photons is described as a series of 'nonlinear Compton-effect'-type processes in which the electrons absorb a large number of laser photons. The use of spectral measurements for the direct verification of quantum effects of nonlinear QED is described. Calculations for even a very high-power CO_2 laser indicate that the high-energy part of the spectrum is severely suppressed in relation to the ordinary Compton-effect spectrum. The contribution is insignificant when the ratio of photon energy to electron energy is greater than 0.5, indicating that this method is not feasible for obtaining high-energy photons. References 8: 7 Russian, 1 Western.
/191-6900/

NUCLEAR PHYSICIST S. A. AZIMOV PROFILED

Tashkent PRAVDA VOSTOKA in Russian 14 Nov 84 p 4

[Abstract] The authors praise the work of Doctor of Physical-Mathematical
Sciences, Professor Sadyk Azimovich Azimov, member of the Uzbek Academy of
Sciences and a leading organizer of nuclear-physics research in the Uzbek
republic, on the occasion of his 70th birthday.

It is recalled that during his early career Azimov took an active part in
nuclear-physics and cosmic-ray research at the Physics Institute of the USSR
Academy of Sciences (FIAN), under the direction of academician V.I. Veksler.
Azimov subsequently organized a cosmic-ray laboratory at the Uzbek Academy
of Sciences' Physical-Technical Institute and obtained extensive experimental
material on interactions between particles with superhigh energies and atomic
nuclei. This material was used in the designing of the first Soviet accelera-
tors. Azimov organized a chair of high-energy physics at Tashkent State Uni-
versity in 1956. Together with U.A. Arifov and S.V. Starodubtsev, Azimov
headed work on the organization of the Uzbek academy's Institute of Nuclear
Physics. Mention is made of close scientific contacts with I.V. Kurchatov
and physicists of FIAN which enabled Azimov to advance many aspects of the
peaceful use of nuclear energy. In addition to basic nuclear-physics research,
work on methods of activation analysis was advanced at the nuclear-physics
institute, which enabled it to become an all-Union coordinating center for
research in this field.

More recently, Azimov has directed research of physical processes in semicon-
ductor structures which led to the discovery of methods for selecting semi-
conductor materials of requisite quality. This in turn made it possible to
develop semiconductor radiation detectors which are being used in space
research, high-temperature plasma diagnostics and other areas of science and
technology. Azimov is praised also as a founder of materials science for
solar-energy technology. He is the director of a broad program of work on
the comprehensive use of solar energy.

Azimov is credited with training 16 doctors and more than 70 candidates of
sciences. It is recalled that a major school of high-energy nuclear physics,
which has earned world recognition, was formed in the Uzbek republic by doc-
tors of sciences who were pupils of Azimov.

A photograph of Azimov is given.

UDC 539.172.4

SPATIAL PARITY VIOLATION IN ELASTIC NEUTRON-NUCLEI INTERACTION CHANNEL

ALFIMENKOV, V. P., Joint Institute for Nuclear Research, Dubna

[Abstract] Investigations of the spatial parity violation in weak inter-
actions are traced historically, beginning with the Feinmann and Gell-
Mann hypotheses on the universality of the weak interaction between fermions
in 1957. The question of P-odd neutron-optical dichroism and birefringence
in association with elastic neutron forward scattering amplitude as a func-
tion of neutron helicity is investigated. Experimental investigations which
have been performed on the P-odd effect in elastic neutron-nuclei inter-
action channels are outlined for the case of cold or thermal neutrons, and
resonance neutrons. Figures 9, tables 3, references 32: 20 Russian,
12 Western.
[172-6900]

UDC 537.533.3

POSSIBILITY OF DEVELOPING CHARGED-PARTICLE ENERGY ANALYZER BASED ON
HYPERBOLOIDAL AXISYMMETRICAL LENS

GUROV, V.S. and SHERETOV, E.P., Ryazan' Electrical Engineering Institute.

[Abstract] The parameters of energy analyzers based on axisymmetrical hyper-
boloid lenses are investigated as a function of a number of design factors:
the geometric factor of the electrode system, the distance from the charged-
particle point source, and the position and size of the selecting slits for
different energies of the analyzed particles. Equations are derived to
describe the movement of charged particles in the field of a hyperboloid
axisymmetrical lens. The operating efficiency of energy analyzers with
different geometries is compared. The optimum geometry for an energy
analyzer based on a hyperboloid axisymmetrical lens is identified. Figures 3;
references: 8 Russian.
[212-6900]

NUCLEAR PHYSICIST YU. B. KHARITON HONORED

/Text/ A bronze bust of academician Yu. B. Khariton, three times Hero of Socialist Labor and laureate of the Lenin and USSR State prizes, was formally unveiled yesterday in the Lane of Heroes in Moscow's Victory Park.

This eminent scientist's activities have been many-sided and fruitful. Linked with his name are many discoveries and basic research in the field of physics which have earned wide recognition in our country and abroad. As a young man, the future scientist's first mentor at the Leningrad Polytechnical Institute was A. F. Ioffe, the founder of a school of Soviet physicists. Academician Yu. B. Khariton is now educating a new generation of researchers. He is directing work on the solution of many critical scientific-technical problems, and he has skillfully combined theoretical profundity with a practical orientation in his works. Of particular importance are his developments in the field of atomic energy and nuclear technology, as are calculations of the uranium-fission chain reaction which were made for the first time by Khariton and Ya. B. Zel'dovich.

Doctor of Physical-Mathematical Sciences S. P. Nikanorov, deputy director of the USSR Academy of Sciences' Physical-Technical Institute imeni Ioffe, academician Ye. P. Velikhov, vice-president of the USSR Academy of Sciences, /and others/ who spoke at the meeting told about the career of this three-time Hero of Socialist Labor and noted the outstanding contribution he has made to the advancement of Soviet science.

FTD/SNAP
CSO: 1862/316

HIGH-ENERGY PHYSICS INSTITUTE BUILDING 3-TRILLION-EV ACCELERATOR

Moscow, MOSKOVSKIY KOMSOMOLETS, 13 Feb 85, p. 4

/Article by S. Kulinich/

/Abstract/ The lengthy article reports on the main thrust of research being done at the Institute of High-Energy Physics (IFVE) in Protvino, and on its facilities. The institute's director, Professor Lev Solov'yev, and deputy director Professor Viktor Yarba, are quoted.

Capabilities and operating procedures of the institute's proton synchrotron are described. Commissioned in 1967, this installation can accelerate particles to an energy of 76 billion electron-volts. The accelerator is said to comprise 22 technological systems, and to consist of 20,000 assemblies. It can operate continuously for a period of 40 days. Five such periods of continuous operation are conducted every year. It is noted that 30 percent of the time of every operating period is made available to scientists of the Joint Institute for Nuclear Research (OIYAI). This institute has installed such research units as the BIS and BIS-2 non-film spectrometers and the "Lyudmila" liquid-hydrogen chamber on the proton synchrotron. It is also mentioned that scientists of the European Nuclear Research Organization currently are conducting their sixth experiment in IFVE.

To advance further into the field of high-energy particle research, IFVE has begun building an accelerator-accumulator complex (UNK) which will have a capacity of 3 trillion electron-volts. A tunnel 21 kilometers long is being dug for it. It is explained that the present proton synchrotron will be used as an injector for the first phase of this complex. Using conventional magnets, this phase will accelerate particles to an energy of 400-600 billion electron-volts. The second phase, which will bring the energy up to the targeted 3 trillion electron-volts, will be equipped with super-conducting magnets operating in a liquid-helium environment.

Commenting on the prospects that are envisaged with the accelerator-accumulator complex, Solov'yev said that it will bring high-energy physics to the stage of probing the quark and developing a theory of the unified nature of interactions. Experiments will be conducted with both fixed targets and counter beams.

PLASMA PHYSICS

INVESTIGATION OF ION-ACOUSTIC PLASMA TURBULENCE IN FIELD OF POWERFUL
El ECTROMAGNETIC WAVE BY CO_2 -LASER RADIATION SCATTERING

BRIZHINEV, M.P., BULANIN, V. V., YEREMIN, B.G., KOSTROV, A.V., PETROV, A.V.
and REVIN, C.G., Applied Physics Institute, USSR Academy of Sciences.

/Abstract/ Ion acoustic oscillations excited in a plasma by scattering of
an electromagnetic wave (CO_2 - laser radiation) is investigated in order to
obtain complete information regarding the ion acoustic amplitude and
spectrum. The appearance of a beat signal from the photodetector and the
signal produced by the accelerated electrons from the collector at the end
of the chamber was found to be temporally correlated, indicating resonant
interaction between the pumping wave and the plasma. The findings indicate
that the action of a strong electromagnetic field on a plasma results in the
excitation of long-wave ion acoustic waves near the plasma resonance point
with energy density significantly lower than the energy density of the
Langmuir oscillations. The ion acoustic wave excitation found in the experi-
ment can occur directly during the development of modulation stability, and
as the result of secondary effects associated with electron acceleration by
Langmuir waves. Figures 3; references: 7 Russian.
/I31-6900/

SOLUTION OF PROBLEM OF EQUILIBRIUM CONFINEMENT OF PLASMA BY MAGNETIC FIELD
IN AN INFINITE CIRCULAR CYLINDER

SULKHANISHVILI, G.I., Georgian SSR Academy of Sciences, Tbilisi Mathematical
Institute imeni A.N. Razmadze.

/Abstract/ This study solves a modeling problem of the equilibrium confine-
ment of plasma by a magnetic field in an infinite circular cylinder. The

solution of the problem is a function of the current for the projection of
the magnetic field onto the plane of the cross section in the cylinder.
The solution of the problem as stated is constructed with the help of a
Bessel function of the first kind for the case in which the domain is a disc.
The free boundary, i.e., the boundary between the plasma and the vacuum, is
established. References 4: 2 Russian, 2 Western.
/192-6900/

INJECTION OF HYDROGEN MACROPARTICLES INTO T-10 TOKAMAK

ANDREYEV, A.P., KUTEYEV, B.V., LOVTSYUS, A.A.A, LUKIN, A. Ya., SKOBLIKOV, S.V.,
UMOV, A.P. and TSENDIN, L.D.

/Abstract/ Initial experiments on the injection of hydrogen pellets with
characteristic dimension $d = h = 1.3$ mm and velocity $V_p \lesssim 0.7$ km·s^{-1} into the
deuterium plasma of a T-10 Tokamak are described. The interaction between
the macroparticles and the Tokamak plasma is investigated for a wide range
of plasma parameters: $B = 1.5 - 3$ T, $I_p = 210 - 500$ kA, $T_c(0) = 0.6 -$
1 keV, $\bar{n}_e = (1.5 - 6) \cdot 10^{13}$ cm^{-3}. The typical evaporation rate is found as
a function of the small radius, and the variation in the average density along
one of the center chords caused by macroparticle injection is analyzed. It
is found that the injection of macroparticles increases the maximum concen-
tration corresponding to stable discharge combustion by 20 to 50 percent.
Injection initiated cutoff only for near-critical plasma densities. No degrada-
tion in stability was observed as q was reduced from 4 to 2. Comparison
with the analytical data shows that evaporation occurs more rapidly than the
model predicts, possibly because the model employed an approximation of the
monoenergetic electron stream. References 8: 1 Russian, 7 Western.
/139-6900/

CCD-BASED X-RAY SPECTROMETER FOR ON-LINE DETERMINATION OF LASER PLASMA
ELECTRON TEMPERATURE

BLAZHENKOV, V.V., VARNAVSKIY, O.P., KIRKIN, A.M., LEONTOVICH, A.M., LIDSKIY,
V.V., MIRZOYAN, R.G. and MOZHAROVSKIY, A.M., Physics Institute imeni P.N.
Lebedev, USSR Academy of Sciences.

/Abstract/ An A-1047 linear video signal generator incorporating two 1024-
element photoregisters and a 24-mm charge-coupled device (CCD) is employed
to record plasma X-radiation. The plasma was produced by an Nd:YAG mode-
locked laser employing 08 x 80-mm active elements. The radiation spectrum

of Mg XI and Mg X ions are analyzed. It is found that charge-coupled devices can be used to record X-ray signals which produce blackening of approximately 0.1 photographically, without cooling the CCD to reduce noise or processing the signals to increase the dynamic range of the device. No degradation in performance was observed over three months of operation of the system. References 8: 5 Russian, 3 Western.
/139-690/

UDC 551.594.221

RADIO-FREQUENCY RADIATION OF STORM CLOUDS

ARABADZHI, V.I., PROKHOROV, Ye.S. and EPSHTEYN, I.I., Gor'kiy Institute of Water Transport Engineers.

/Abstract/ It is proposed that the radio-frequency radiation occurring during storms over water and during the disintegration of water droplets in storm clouds can be explained through the retardation of electrical discharges upon the destruction of water films. The electrical discharge, as in the balloelectric effect, takes the form of heavy and ultraheavy ions, escaping in all directions. The phenomenon is similar to the occurrence of X-ray brehmstrahlung. References: 5 Russian.
/212-690/

UDC 534.222.2

LOWER BOUNDS OF PROPAGATION VELOCITY OF STEADY IONIZING WAVES IN FIELD OF STRONG ELECTROMAGNETIC WAVE

BUDNIK, A.P., VAKULOVSKIY, A.S., POPOV, A.G. and SVIRKUNOV, P.N., Experimental Meteorology Institute, Obninsk.

/Abstract/ Lower bounds are obtained for the propagation velocity of steady plane ionizing waves in the field of an electromagnetic wave, taking into account photoionization by intrinsic ultraviolet emission and electron diffusion. It is shown that allowing for ionization of the excited states of atoms (molecules) can only increase the lower bounds of the wave velocity. An example of optical discharges in argon is presented for illustration. It is found that when the radiation intensity exceeds 150 MW/cm^2, optical discharges propagate at a velocity exceeding the light detonation velocity. Figures 1; references: 12 Russian.
/212-690/

AMPLIFICATION OF ELECTROMAGNETIC WAVE BY ELECTRON STREAM WITH NEGATIVE
VELOCITY DIFFERENCES

YEVDOKIMENKO, Yu.I., LUKIN, K.A. and SHESTOPALOV, V.P., Institute of Radio
Physics and Electronics, Ukrainian SSR Academy of Sciences.

/Abstract/ It is demonstrated that an external electromagnetic or Langmuir
wave can be amplified by a rectilinear stream of electrons when the phase of
the wave changes abruptly in the path of the electrons. The interaction
between a single-velocity electron stream and the longitudinal component of
the field of a wave is modeled. It is shown that, in the nonlinear stage of
amplification, the electrons separate into two groups - a group of trapped
particles and a group of drifting particles. Most of energy transfer is via
these drifting electrons. It is found that if n jumps occur in the phase of
the wave in the path of the electrons, the wave may be amplified in initial
electron velocity change interval n + 1, with the amplification intervals
alternating with intervals in which the wave energy is absorbed. Figures 2;
references: 10 Russian.
/212-6900/

ELECTROMAGNETIC WAVE AMPLIFICATION DURING CYCLOTRON RESONANCE IN A MEDIUM

AVETISYAN, G.K. and ATSAGORTSYAN, K.Z., Yerevan State University.

/Abstract/ The possibility of electron-beam amplification of an electro-
magnetic wave in a refracting medium in the presence of cyclotron resonance
is investigated. The process of particle acceleration or multi-photon
emission caused by nonlinear resonance is investigated from the viewpoint of
wave amplification. The linear wave gain is found on the basis of self-
consistent Maxwell-Vlasov equations for the case of kinetic instability of
the electron beam. Formulas are derived for the behavior of the gain in dif-
ferent limiting cases. Numerical estimates are presented. References 8:
7 Russian, 1 Western.
/212-6900/

PLASMODYNAMIC METHODS FOR GENERATING POWERFUL LIGHT PULSES

ALEKSANDROV, A.F. and TIMOFEYEV, I.B., Moscow State University.

[Abstract] The use of plasmodynamic methods to produce high-power radiating
plasmas are reviewed. The use of classical Z-pinch geometry to produce
microsecond pulses in inert gases is analyzed. The processes occurring in
the initial stages of the discharge are found to be explained satisfactorily
by the model of radiation magnetohydrodynamics. The generation of 'plasma
focus' discharges, mainly by erosion-type magnetoplasma compressors, is
discussed. A dense plasma jet exiting the nozzle of a powerful pulse plasmo-
tron into the air is outlined. Plasmodynamic methods are found to be highly
effective for producing high intensity radiation sources with brightness
temperatures of $2 - 10$ eV, making it possible to create better-quality
and more powerful sources in the ordinary and vacuum ultraviolet regions of
the spectrum. Dynamic Z-pinch geometry makes it possible to implement
elongated linear or cavity-type sources; the use of magnetoplasma compressors
is preferable for obtaining near-point high-temperature sources. The
injection of a dense plasma into a gas makes it possible to produce strong
open-type sources with long pulse durations but relatively low brightness
temperature. Figures 12; references 45: 44 Russian, 1 Western.
[44-690]

CHARACTERISTICS OF OPTOGALVANIC EFFECT IN MEDIA WITH INVERSE POPULATIONS

BURAKOV, V.S., corresponding member, Belorussian SSR Academy of Sciences,
MISAKOV, P.Ya., NAUMENKOV, P.A. and RAYKOV, S.N., Physics Institute,
Belorussian SSR Academy of Sciences.

[Abstract] This study investigates the basic characteristics of the opto-
galvanic effect during resonant interaction between laser radiation and
glow-discharge plasma in mixtures with inverse population of the investi-
gated levels. Glow-discharge in a helium-neon mixture consisting of the
plasma produced by the active element in an LG-56 helium-neon laser is
described. Glow-discharge plasma in pure neon and the plasma of a neon-
filled hollow cathode are investigated for comparison. The experimental
findings agree satisfactorily with qualitative estimates of the contribution
of certain elementary processes to the formation of the optogalvanic

response for positive-column plasma as well as hollow-cathode plasma.
Figures 2; references 10: 4 Russian, 6 Western.
/6900-158/

CYCLOTRON ABSORPTION OF FAST MAGNETOSONIC WAVE IN STELLARATOR

KOVRIZHNYKH, L.M. and MOROZ, P.Ye.

/Abstract/ This study investigates the helical nature of the confining
magnetic field of a stellarator, in which the absorption can be significantly
greater than in a tokamak with similar present parameters. The possibility
of strong absorption of the fast magnetosonic wave in a stellarator plasma
is demonstrated theoretically for the case of cyclotron resonance conditions
of the primary ions. References 8: 2 Russian, 6 Western.
/6900-153/

A SYSTEM OF MAGNETOHYDRODYNAMIC-TYPE EQUATIONS

CHIZHONKOV, Ye.V., Moscow State University imeni M.V. Lomonosov

/Abstract/ Theorems for the existence and uniqueness of a generalized
solution are proved for a system of steady-state magnetohydrodynamic-type
equations. Second-order approximation difference schemes are constructed
for an extensive group of areas; an interative method is proposed for sol-
ving the resulting system of nonlinear algebraic equations requiring on the
order of $O(h^{-2}\ln\ h^{-1}\ \ln\ \varepsilon^{-1})$ arithmetic operations to obtain a solution
to within ε in the two-dimensional case. A steady-state system of magneto-
hydrodynamic equations for a viscous incompressible liquid with finite
conductivity is studied as an example. References: 10 Russian.
/I13-6900/

INVESTIGATION OF SPACE-TIME STRUCTURE OF GLOW OF LASER PLASMA COLLIDING
WITH FLAT SCREEN

BOYKO, V.A., BRYUNETKIN, B.A., BUNKIN, F.V., GORBENKO, B.Z., DERZHIYEV, V.I.,
DYAKIN, V.M., MAYOROV, S.A., SKOBELEV, I.Yu., STEPANOV, B.M., FAYENOV, A.Ya.,
FEDOSIMOV, A.I., SHEKHOVTSOV, V.N., SHILOV, K.A. and YAKOVLENKO, S.I.,
All Scientific Research Institute for Physical-Technical and Radio Technical
Measurements

/Abstract/ The space-time behavior of the glow of a laser plasma colliding
with a flat screen is investigated with the help of a high speed Agat-SF
photochronograph. The plasma was heated by an Nd laser producing pulse
energy of 20 - 30 J, with the radiation focused into a 0.2 x 30 nm line.
The Agat-SF photochronograph was employed to record the space-time behavior
of the plasma glow in the 400 - 480 nm and 480 - 560 nm spectral bands.
The behavior of the plasma glow during free expansion and during inter-
action with a flat screen are investigated. It is found that the presence
of a screen intensifies the plasma glow at large distances from the target,
and that the plasma glow in the 400 - 480 nm band is caused mainly by the
line radiation spectrum of the Be II ion. It is found in general that the
basic characteristics of recombining laser plasma glow are closely asso-
ciated with the structure of the shockwave front. Figures 8; references
15: 14 Russian, 1 Western.
/111-6900/

DIAMAGNETIC INSTABILITY OF CYCLOTRON WAVES IN PLASMA

BORODACHEV, L.V. and NEKRASOV, A.K., Department of Mathematics.

/Abstract/ The existence of a diamagnetic effect is demonstrated for the
first time by mathematical modeling of a magnetoactive plasma. The modula-
tion instability of the pumping wave associated with the diamagnetic effect
is investigated. Spontaneous focusing and compression increments are ob-
tained. Numerical experiments are described in which the development of
diamagnetic instability is investigated in detail. The theoretical estimates
of the increments are compared with the numerical values, and the analytical
relationships between the number and depth of magnetic holes and pumping
intensity are verified. The analytical results agree well with the theory.
References: 8 Russian.
/104-6900/

INFLUENCE OF ECR-HEATING ON MHD ACTIVITY OF PLASMA IN TOKAMAK-10 INSTALLATION

ALIKAYEV, V.V. and STEPANENKO, M.M.

[Abstract] A series of experiments was conducted on the T-10 Tokamak to
determine the influence of electron-cyclotron resonant (ECR) heating on the
(2/1) mode intensity during heating near the resonance surface q = 2.
An oscillogram of the envelope of the (2/1) mode signal shows that heating
destabilizes the (2/1) mode (doubling the signal) in the presence of ECR
heating near the surface q = 2; the mode is stabilized when heating
occurs away from the surface (the signal is reduced by approximately an
order of magnitude). The signal value is proportional to the product of
the amplitude and frequency of the emf induced on the coil. The findings
confirm in principle that the concept of stabilizing (2/1) MHD instability
by increasing the electron temperature away from the rational surface q = 2
is fundamentally correct. Figures 3; references 4: 1 Russian, 3 Western.
[131-6900]

OPTICS AND SPECTROSCOPY

COMPARISON OF FINDINGS OF THEORIES DESCRIBING REFLECTION FROM REAL SURFACES WITH EXPERIMENTS IN REGION OF ULTRASOFT X-RADIATION

GRUDSKIY, A.Ya.

/Abstract/ This study investigates the reflection and scattering of ultra-soft X-radiation from real mirror surfaces and compares the experimental findings with existing theoretical models describing the reflection of electromagnetic radiation from rough surfaces. It is found that P. Beckman's model describes the experimental findings well, and that the roughness of a real mirror can influence the calculation of the optical constants of materials based on the angular relationships of the coefficient of reflection. Thin layers can be applied in order to improve the quality of the substrate in preparing multi-layer X-ray mirrors, indicating that it should be possible to develop multi-layer coatings on complex surfaces such as spheres, parabolas and hyperbolas. Figures 2; references 11: 7 Russian, 4 Western. /146-6900/

ATMOSPHERIC OPTICS SCIENTIST NOTES PLANS FOR LASERS IN SPACE

Moscow SOVETSKAYA ROSSIYA in Russian 29 Jan 85 p 1

[Article by V. Dolmatov, correspondent (Tomsk)]

[Abstract] The article is an interview with Academician Vladimir Yevseyevich Zuyev, founder and director of the Institute of Atmospheric Optics in Tomsk, on the occasion of his 60th birthday and his receiving of the Order of Lenin.

A preface to the interview notes that Zuyev has devoted his whole life to spectroscopy research. In addition to his institute post, he serves as chairman of the presidium of the Tomsk affiliate of the Siberian Branch of the USSR Academy of Sciences. He is an honorary member of the American Optical Society.

Asked what he considers his foremost accomplishments, Zuyev cited studies of atmospheric optics, and the creation of unique laser complexes. Asked about the efforts that his institute's staff devotes to applied science and whether this does not detract from the basic research obligation of an academy institute, Zuyev replied he is firmly convinced that the director of any institute has a duty to work actively toward practical applications of scientific advances. He noted that his institute earns 10 million rubles annually, which represents as much as 75 percent of its budget, from con- tract research for industry. At the same time, he said it makes a contribu- tion to advancing theory, noting that four doctoral dissertations were defended and six more were submitted for defense in 1984. No conflict is seen between theory and practice, he said, explaining that part of the staff works on theoretical developments alone, others check them experimentally, and a third group develops models of new technology. Finally, the institute has a special design bureau where test prototypes are perfected for use in industry. Asked about former students of his who have become leading scien- tists, Zuyev named Yuriy Semenovich Makushkin, president of Tomsk University, and Mikhail Vsevolodovich Kabanov, director of the Siberian Physical- Technical Institute.

In conclusion, Zuyev was asked about his institute's R&D plans. He replied: "The plans are beyond reckoning! We expect a great deal from laser probing of the atmosphere directly from spacecraft. Weather forecasting will be revolutionized when we succeed in obtaining routinely needed data on the

condition of the atmosphere at all latitudes, longitudes and altitudes simul-
taneously. Short-range forecasts will become highly accurate, and long-
range ones more reliable. Another task--routine probing of pollution of
the atmosphere and of the seas and oceans from space--will be accomplished
at the same time..."

FTD/SNAP
CSO: 1862/258

EFFECTIVE BRIGHTNESS OF ZERO-POINT FLUCTUATIONS OF THE ELECTROMAGNETIC VACUUM
ACCOMPANYING PARAMETRIC SCATTERING OF LIGHT

ABROSKINA, O. N., KITAYEVA, G. Kh. and PENIN, A.N., Moscow State University
imeni M. V. Lomonosov

/Abstract/ The contribution of zero-point fluctuations of the electromag-
netic vacuum to three-wave parametric interaction of electromagnetic
radiation in a nonlinear medium was measured. The results agreed well with
the theory, which predicts that the number of photons N_1 (channel 1) leaving
the scattering medium as a result of parametric conversion of radiation in
the presence of intense pumping radiation is related to the number of input
photons N_2 (channel 2) by the relationship $N_1 = F_{12}(N_2 + 1)$, where F_{12} is
the parametric conversion factor, and the factor of unity added to N_2 is
due to the zero-point fluctuation of the vacuum. The contribution of the
zero-point fluctuations was determined by comparing the value of N_1 for
$N_2 = 0$ and $N_2 \neq 0$. The experiments were performed using 100 mW of pumping
radiation at 488 nm. A lithium niobate crystal was used as the nonlinear
medium. The wavelength in the signal channel 1 was varied in the range
500-550 nm and the wavelength in bias-illumination channel 2 was varied in
the range 2000-5000 nm. The radiation was recorded using a photomultiplier
in the photon-counting mode and with a digital synchronous detection circuit.
It was verified that the brightness of the zero-point fluctuations did not
depend on the reflection and absorption of radiation in the medium. Figures
2, references 6: all Russian.
[242-9638/

UDC 621.373.029:535.36

CORRELATION OF INTENSITIES OF DIFFERENT SCATTERING CHANNELS

BURKITBAYEV, S.M., KUSHNIR, V.P. and MANYKIN, E. A.

[Abstract] This study investigates the problem of determining the nu r
of types of radiation sources and the spectrum of each source through
correlation spectroscopy of the observed combined spectrum by analyzing
the correlations between channels differing in energy and/or types of radia-
tion. The scattering of light by an ensemble of particles exhibiting
Brownian movement is investigated as an example. It is assumed that the
movement of individual particles is statistically independent of that of
others. The different scattering channels are separated by introducing
frequency filters with a passband that is much smaller than the character-
istic widths of the sought spectrum on the one hand, and significantly
greater than the characteristic frequencies of the intensity fluctuations
on the other. An expression is derived for the non-gaussian term of the
cross-correlation function for the fields passing through the filters.
The findings can be extended to numerous stochastic ensembles of radiation
sources, such as centers which scatter external sounding radiation, or active
sources that radiate due to internal dynamics. References 4: 3 Russian,
1 Western.
[137-6900]

UDC 541.11:541.14:535.217

ABSORPTION OF LASER RADIATION IN SUBSTANCE WITH ABSORPTION COEFFICIENT
DEPENDING LINEARLY UPON TEMPERATURE

YEDVABNYY, I.V. and UBAYDULLAYEV, S.A., Institute of Nuclear Physics,
Uzbek SSR Academy of Sciences.

[Abstract] Absorption wave propagation is investigated in a medium in
which the absorbing component is unstable at temperatures below the decomposi-
tion temperature and the decomposition products are transparent to laser
radiation. A formula is derived that relates the velocity of the absorption
wave to the intensity of the laser radiation. References: 2 Russian.
[6900-160]

OPTICAL WAVEGUIDE ALONG FRONT OF EXOTHERMIC REACTION

LEF"   P.B. and LUK'YANCHUK, B.S., General Physics Institute, USSR Academy
of s ences.

[Abstract] The formation of an optical waveguide along an exothermic
reaction front is investigated. The basic linear, and some nonlinear,
optical characteristics of this waveguide are assessed. The front of a
laminar flame along which laser radiation propagates is examined. The
change in the profile of the index of refraction along the front is analyzed.
The conditions are specified under which a local maximum of the index of
refraction can form near the front of an exothermic reaction, making wave-
guide light propagation possible. The characteristic parameters of the wave-
guide formed are estimated in parabolic approximation. The estimates indi-
cate the possibility of observing such a waveguide experimentally. Figures
1; references: 9 Russian.
[212-6900]

ELECTROSTATIC ASTIGMATIC TUBULAR LENS

GRIKMAN, L.G., ISKAKOVA, Z.D. and PETROV, I.A.

[Abstract] The electron-optical properties are described for a new electro-
static astigmatic tubular lens with equal radius electrodes separated by an
infinitely small clearance, whose facing edges each have two protrusions
and notches that are bounded by lines parallel to the optical axis of the
lens and planes perpendicular to that axis. The potential distribution is
found, and the paraxial properties of the lens are examined. In addition
to design simplicity, the lens has far greater optical strength than the
astigmatic tubular lens with electrodes whose facing edges contain protru-
sions and notches bounded by the line of intersection of two cylinders with
the same radius; the effect of the lens on a beam of charged particles is
similar to that of a quandrupole lens with an axisymmetrical field component.
Figures 5; references: 7 Russian.
[212-6900]

UDC 538.74.4

FLUCTUATIONS IN LIGHT INTENSITY DURING BACKSCATTERING IN TURBULENT MEDIUM

KASHKAROV, S. S., NESTEROVA, T.N. and SMIRNOV, A.S., Atmospheric Physics
Institute, USSR Academy of Sciences.

[Abstract] This study presents findings from measurements of the fluctuations
in intensity of a spherical light wave reflected by a point scatterer lo-
cated behind a turbulent layer. The relative dispersion of the intensity
fluctuations of the scattered radiation is investigated as a function of the
statistical moments of the intensity fluctuations in the radiation incident
on the scatterer, and of the distance between the radiation source and the
device which receives the scattered radiation. The relationships between
the statistical moments of the fluctuations in the radiation incident on the
scatterer and reflected therefrom agree with the predicted values. The
fluctuations are observed to increase at scattering angles within $\pm 2 \cdot 10^{-4}$
rad of π . Increased numbers of scatterers cause changes in the flicker
index of the backscattered radiation: the value of the flicker index of back-
scattered radiation is determined by the size of the fourth moment of the
intensity fluctuations in the radiation incident on the scatterer.
References 13: 12 Russian, 1 Western.
[143-6900]

UDC 535.316:532.72

RELAXATION LENS IN INHOMOGENEOUS BINARY MIXTURE

BRUK-LEVINSON, E.T., PLOKHOTSKI, Z. and KHODAN, I.V., Institute of Heat and
Mass Exchange imeni A.V. Lykov, Belorussian SSR Academy of Sciences;
Institute of Fundamental Engineering Problems, Polish Academy of Sciences.

[Abstract] This study demonstrates a quasi optical system, occurring in an
inhomogeneous binary mixture, that can be interpreted as a thin relaxation
lens with optical characteristic. ...ined by the coefficient of diffusion
of the mixture. A binary mixture of uniform concentration distribution is
suddenly disturbed by adding a small amount of the same type of mixture, but
with a higher concentration than one of the components. As a result of
diffusion, the inhomogeneous distribution of the concentration in the mix-
ture begins to relax, causing a corresponding relaxation in the distribution
of the index of refraction. A light beam striking such a system is deflected,
with angle of deflection being a function of time and coordinate. A linear
formula is derived which relates the coefficient of diffusion with the time

derivative of the logarithm of the angle of deflection of the incident light
beam. The resulting formation is found to be focusing or defocusing,
depending upon the ratio of the indices of refraction of the pure components.
Figures 2; references: 3 Russian.
/6900-158/

UDC 550.388.2

BEAM DIFFUSION IN 'LINEAR' IONOSPHERIC LAYER

GUSEV, V.D. and VLASOVA, O.K., Department of General Physics and Wave
Processes.

/Abstract/ The use of the Einstein-Fokker equation to describe beam
scattering in a medium with a regular gradient of the index of refraction
is investigated for the case of oblique incidence of radio waves on an
ionospheric layer. An equation describing the beam is derived in the
parabolic cylindrical coordinate system, and an expression for beam
dispersion is proposed. It is found that the arc length of the beam can be
replaced with a coordinate along the unperturbed trajectory for the case of
oblique propagation only when the permittivity layer is linear. The
approach can be extended to other models of the medium by using machine
processing. References: 7 Russian.
/104-6900/

UDC 621.378.325

COEFFICIENT OF OPTICAL ABSORPTION AND SCATTERED LIGHT CAPTURE EFFECT

MITSAY. L.I. and NEMËNOV, V.A., All Union Scientific Research Institute for
Single Crystals, Khar'kov.

/Abstract/ This study investigates the absorption of laser radiation
scattered on optical inhomogeneities of a material. The laser radiation
power scattered in the specimen and converted to heat is determined. Ana-
lytical expressions are obtained for KCl, CsI and ZnSe to estimate the
contribution of scattering to the measured optical absorption coefficient.
Analyses are made for large impurities, and for small ones uniformly distri-
buted through the specimen. Computer modeling of the trajectories of
random beams is employed to find the angular distribution of the light
intensity scattered on large impurities. This distribution and the capture

conditions, i.e., the form and index of refraction of the specimen, as well
as the distribution of the laser radiation intensity in the cross section
of the beam, are used to calculate the amount of scattered radiation that
is converted to heat. References 12: 9 Russian, 3 Western.
/148-6900/

METHODS FOR MEASURING AND ANALYZING DISPERSION PROPERTIES OF MULTIMODE
FIBER OPTIC LIGHTPIPES (A REVIEW)

BABKINA, T.V., GRIGOR'YANTS, V.V. and SMIRNOV, V.B., Radio Engineering and
Electronics Institute, USSR Academy of Sciences, Moscow; Scientific
Research Institute for Physics, Leningrad State University imeni A.A. Zhdanov.

/Abstract/ This study reviews multimode fiber optic lightpipes with step
and gradient refraction index profiles. The fundamental mechanisms under-
lying light pulse dispersion in fiber optic lightpipes are outlined. The
influence of mode coupling on intermode dispersion is explained. The
interpretation of a fiber optic lightpipe as a linear system, and the
characteristics of that system within the class of linear systems, are
presented. Methods for describing the dispersion properties using time and
frequency representations are outlined, and hardware implementation and the
processing of measurements based on these representations are discussed.
A comparison is made of the results of measuring the dispersion properties
of fiber optic lightpipes in the time and frequency domains. The effect of
irregularities in the refraction index profile, caused by manufacturing
defects, on the passband of the waveguide is discussed, and compensation
methods are outlined. Figures 30; references 167: 58 Russian, 109 Western.
/148-6900/

STIMULATED MANDELSTAM-BRILLOUIN SCATTERING WITH DISTRIBUTED FEEDBACK

ZASKAL'KO, O.P., ZOZULYA, A.N., KYZYLASOV, Yu.I., PANAIOTI, N.N., SILIN, V.P.,
TIKHONCHUK, V.T. and FABELINSKIY, I.L., Physics Institute imeni P.N. Lebedev,
USSR Academy of Sciences.

/Abstract/ Low-threshold stimulated Mandelstam-Brillouin scattering with
distributed feedback is proposed and obtained experimentally for the case of
nearly antiparallel pumping beams. The distributed feedback is achieved by
Bragg diffraction of the Mandelstam-Brillouin radiation on a spatially-
periodic lattice of the index of refraction induced in an optically-nonlinear

medium (carbon bisulphide) by interference between two light beams. The
use of distributed feedback makes it possible to obtain single-frequency
Mandelstam-Brillouin radiation with good energy efficiency and little
angular divergence. A theory is developed for the phenomenon which makes
it possible to calculate the coefficient of conversion of the pumping
energy to Mandelstam-Brillouin radiation and to determine the optimum
direction of generation and the distribution of the amplitudes of the
waves interacting in the nonlinear medium. Comparison of the experimental
and theoretical findings indicates good agreement. The proposed Mandelstam-
Brillouin converter system has a low lasing threshold, a high quantum
yield, exhibits no higher Stokes components and has small angular divergence.
Figures 6; references 10: 7 Russian, 3 Western.
/6900-153/

INFLUENCE OF PHONON INTERACTION ON WIDTH AND FORM OF MANDELSTAM-BRILLOUIN
OPTICAL SCATTERING LINE

GANTSEVICH, S.V., KAGAN, V.D., KATILYUS, R. and RZAYEV, E.A., Physical-
Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences.

/Abstract/ The scattering of light on interacting long-wave low frequency
phonons is investigated theoretically for intensities significantly exceeding
the equilibrium value. The analysis is performed for phonons interacting
through a dissipative electronic system. The adaptation of kinetic diagram
techniques for studying light scattering is described. Nonlinear effects in
the phonon system and their influence on the form of the Mandelstam-
Brillouin scattering line are investigated. Non-Peierls interaction through
the electron density wave is employed as a specific phonon-phonon inter-
action mechanism. An expression is derived for the intensity of the
scattered light. Mandelstam-Brillouin scattering is analyzed for the case
in which the phonon intensity increases along the specimen, which is typical
for experimental conditions. Figures 4; references 11: 9 Russian, 2 Western.
/6900-153/

UDC 517.946

SOLVABILITY OF SOME INVERSE PROBLEMS OF LASER RADIATION FOCUSING

GONCHARSKIY, A.V., SISAKYAN, T.N. and STEPANOV, V.V., Moscow State
University imeni M.V. Lomonosov.

[Abstract] This study addresses the solvability of some inverse problems
of coherent optics, and investigates the following set of related problems:
1) selection of the model; 2) solvability of the synthesis problems; 3)
uniqueness of solution of solvability problem; 4) correctness of algorithms
for solving inverse problem. The problem of focusing coherent radiation
in an arbitrary focal curve with assigned intensity distribution is solved
using the approximation of geometric optics. A theorem is presented that
provides sufficient existence conditions for smooth solutions of the inverse
synthesis problem. Programmable optical elements which focus laser radia-
tion in an arbitrary focal curve have been developed on the basis of the
present theory. References: 4 Russian.
[29-6900]

UDC 621.373.826

INFLUENCE OF SPATIAL PUMPING SPECTRUM ON QUALITY OF PHASE CONJUGATE
REFLECTION DURING 4-PHOTON INTERACTION

IVAKHNIK, V.V., Kuybyshev State University.

[Abstract] The influence of the spatial spectrum of the pumping waves on
the quality of phase conjugate reflection is investigated using the
example of degenerate 4-photon interaction. A truncated equation is
derived for 4-photon parametric interaction in a flat nonlinear layer.
Relationships are found between the amplitudes of the spatial spectra of
the object and signal waves at the output of the nonlinear medium; the
kernel of the integral operator in the expression for the amplitude of the
spatial spectra describes phase conjugate reflection quality by a 4-photon
radiation converter. An expression is found for the amplitude of the field
of the object wave at the output of the parametric radiation converter that
indicates the possibility of describing said converter with the help of
a phase conjugation diaphragm with transmission $T(\rho) \sim A_1 \rho A_{20}$. References
5: 4 Russian, 1 Western.
[92-6900]

NEW METHOD FOR CORRECTING CHROMATISM OF MIRROR-LENS OBJECTIVES

SOKOLOV, N.L.

[Abstract] An analytical method developed by the author for correcting
spherochromatic abberrations is demonstrated by the example of developing
a mirror-lens objective. Rather than trying to select only one type of
optical glass for the mirror-lens objectives which is apochromatic over a
wide portion of the spectrum, an apochromatic field abberration compensator
is employed with enough optical strength to correct the curvature of the
field of view. The method can be used to obtain an apochromatic system by
combining a positive compensator in a parallel beam of rays with a Mangin
mirror made of the same type of glass and to optimize that system as a part
of the mirror-lens objective. The chromatism correction method has been
used successfully to develop different versions of mirror-lens objectives.
Figures 1; references 16: 13 Russian, 3 Western.
[108-6900]

DIELECTRIC MIRROR WITH FERROMAGNETIC SUBSTRATE

BORISOVA, M.S. and CHERNYKH, Ye.N.

[Abstract] The reflection matrix of a ferromagnetic mirror with a multi-
layer dielectric coating applied to increase the coefficient of reflection,
to permit operation in the cavity of neon-helium laser operating in the
0.63 or 1.15 µm region, is investigated. The reflection matrix is
defined for a mirror with a ferromagnetic substrate and isotropic dielectric
layers. A 6-layer dielectric mirror consisting of alternating layers of
cryolite and zinc sulphide on a ferromagnetic substrate is analyzed as an
example. It is found that the 6-layer coating reduces the phase non-
reciprocity from approximately $6 \cdot 10^{-3}$ to approximately $4 \cdot 10^{-4}$ while
increasing the amplitude coefficient reflection for p-polarization from 0.77
to 0.98. The amplitude nonreciprocity drops by two orders of magnitude, and
the polarization characteristics of the mirror are improved. References 7:
6 Russian, 1 Western.
[108-6900]

THE FARADAY EFFECT IN RUBY AND CORUNDUM IN STRONG MAGNETIC FIELDS

BOYKO, B.B., academician, Belorussian SSR Academy of Sciences, and SOYKA, A.K.,
Solid State and Semiconductor Physics Institute, Belorussian Academy of
Sciences.

[Abstract] The Faraday rotation of the polarization plane of light in ruby
and corundum is investigated experimentally at room temperature in strong
pulsed magnetic fields of up to 810 KOe. The experiments employed geometri-
cally identical specimens of corundum and ruby made from a single crystal
(a laser ruby rod with corundum end pieces and Cr^{3+} ion concentration of
approximately $1.6 \cdot 10^{19}$ cm^{-3}). The sounding radiation consisted of plane-
polarized light from a helium-neon laser at 632.8 nm. The angle of rotation
of the light polarization plane is found to vary linearly as the strength of
the magnetic field. The Verde constants for ruby and corundum were found to
be within 7% of 0.353 and 0.375 deg/(KOe. cm), respectively. The findings
indicate that the Verde constant is determined, under the conditions present
in the experiment, by the diamagnetic term caused by Zeeman splitting of
degenerate energy states occurring in the Faraday effect, i.e., splitting
of the lines at the same frequency (in the absence of the field), but with
different polarization. The Verde constant is independent of the magnetic
field and temperature in this case. References: 5 Russian.
[133-690]

OPTICAL IMAGE OF BOUNDED OBJECTS. I.

VOROB'EV, Yu.V.

[Abstract] A study is made of the images of isolated bounded objects with
characteristic dimensions assumed to be known a priori and comparable to
the least resolved distance of the optical system. An eigenfunction expan-
sion apparatus is developed for recovering images distorted by aberrations
of the optical system and by diffraction for the case in which the response
function is axisymmetrical. This approach makes it possible to compare
different optical systems in representing bounded isolated objects.
Reconstruction of the images of objects with dimensions smaller than the
theoretical resolution limit is analyzed as an example. References 4:
3 Russian, 1 Western.
[146-690]

TRANSMISSION OF LIGHT BY DISPERSE MEDIUM OF DENSELY PACKED OPTICALLY SOFT
PARTICLES

DIK, V.P., IVANOV, A.P. and LOYKO, V.A.

[Abstract] This study investigates the characteristics of light transmis-
sion by densely packed layers of 'soft' particles, i.e., particles for
which the relative index of refraction is near unity. The experiment was
conducted by measuring the coefficient of transmission of a turbid medium in
rarified and densely packed states with the same amount of disperse matter.
It is found that the attenuation of radiation passing through a densely packed
medium depends upon the scattering index: the more diffuse the medium, the
smaller the scattering index. A 'thickness' mode is found to occur in a
rarified disperse medium in the region in which the particles are suspended.
This mode also occurs in a densely packed system, and begins with larger
overlap coefficients than for a rarified medium. The results indicate that
clarification effects do not change the principles of light attenuation by
thick weakly absorbing layers of a disperse medium. Figures 3; references 17:
15 Russian, 2 Western.
[146-6909]

THEORETICAL PHYSICS

UDC 537.8

EQUATIONS OF MOTION FOR ELECTROMAGNETIC WAVES IN 4-DIMENSIONAL EUCLIDIAN
SPACE

VATOLIN, Yu.N., Novosibirsk Agricultural Institute.

/Abstract/ This study investigates the possibility of extending Maxwell's
equations to a space described by four Cartesian coordinates. New non-
trivial relationships are found between the physical quantities character-
izing the electromagnetic fields. The possibility of substantiating a
purely electromagnetic nature of the mass of charged particles is analyzed.
Formulas are derived that ensure the necessary existence conditions for
physical realization of inertial frames of reference entirely electromagnetic
in nature. The possibility of solving the problem of spontaneous particle
self-action is investigated.
/122-6900/

MATHEMATICS

UDC 518.9

DISCRETE MOVING-OBJECT SEARCH PROBLEM

CHIKRIY, A.A., Cybernetics Institute, Ukrainian SSR Academy of Sciences, Kiev.

[Abstract] This study investigates the discrete game problem of the convergence of a conflict-controlled discrete system with an assigned set when the initial state distribution density is known. The probability of the system trajectory hitting the required set in a finite amount of time is found by computing the minimax (maximin) or multiple minimax (maximin) of a certain known function depending upon the amount of information available as the game progresses. References: 9 Russian.
[132-6900]

UDC 517.941.92

CONTROL WITH A DEFICIENCY OF INFORMATION

KRASOVSKIY, N. N., Academician, Institute of Mathematics and Mechanics, Ural Scientific Center of the USSR Academy of Sciences

[Abstract] The problem of determining an optimal control strategy for dynamic systems governed by equations of the form $x = A(t)x + B(t)u + C(t)v$ for $t_0 \leqslant t \leqslant T$, was studied for the situation in which the initial conditions are uncertain and the noise is a stochastic function that remains unknown during the control process. Here x, u, and v are the state vector of the system, the control vector, and the dynamic noise vector and A, B, and C are continuous matrix functions of time. The problem was reduced to a problem in mathematical programming by applying a method developed

previously by the author -- the method of programmed stochastic synthesis.
The synthesis was implemented in this case with the use of Brownian func-
tions, the solutions of the dynamic equations with parameterized control
and v = 0, and complicated indicator functionals. References 4:   all Russian.
/242-9638/

HIGH-ORDER REGULARIZATION METHODS FOR INACCURATELY-SPECIFIED INITIAL DATA

VASIL'EV, F.P., Moscow State University imeni M. V. Lomonosov

[Abstract] Let H represent a real Hilbert space with scalar product $\langle u,v \rangle$
and norm $\| u \| = \langle u,u \rangle^{\frac{1}{2}}$; $\mathcal{J}(H\ H)$ represents the space of the linear
bounded operators mapping H into H. The minimization problem
(1) $J(u) \to \inf$, $u \in U$;
(2) $U = \{u \in H: g_i(u) < 0, i = 1,2,\ldots, m; g_i(u) = 0,$
$i = m + 1, m + 2, \ldots, s\}$,
is examined, where $J(u)$, $g_1(u)$, $g_2(u),\ldots,g_2(u)$ are functions defined
and twice Fréchet-differentiable on H. Let
(3) $J_* = \inf_U J(u) > -\infty, U_* = \{u \in U: J(u) = J_*\} \neq \emptyset$. A normal solution u_* is

sought for problems (1), (2), such that $u_* \in U_*$, $\| u_* \| = \inf_{U_*} \| u \|$.   Inasmuch

as the problem of finding u_* is ill-defined, the use of regularization
methods to solve it is required. Regularized versions of the Steffensen
and third-order method are proposed for the case in which only the
approximate first and second Fréchet derivatives of the functions $J(u)$
and $P(u)$ are known. References 10 Russian.
/137-6900/

ON ONE NONLINEAR PROBLEM OF LASER THERMOCHEMISTRY

BUNKIN, F. V., Corresponding member, USSR Academy of Sciences,
GALAKTIONOV, V.A., KIRICHENKO, N. A., KURDYUMOV, S. P. and Academician
SAMARSKIY, A. A., Institute of General Physics, USSR Academy of Sciences,
Institute of Applied Mathematics imeni M. V. Keldeysh, USSR Academy of
Sciences

/Abstract/ This study investigates the typical properties of the solutions
of those equations describing the occurrence of several steady states,
localization effects and complex changes in the temperature field caused by
the thermal action of laser radiation on chemically active media. Effective
approximate methods are sought for finding the solutions. Surface heating
of a metal specimen exposed to laser radiation is examined. The solution
of a boundary problem to determine presence and number of steady-state solu-
tions is investigated. The stability of the steady-state is analyzed by
applying the theory of non-steady-state averaging to the boundary problem
derived. The investigation is for the case of Gaussian distribution of the
radiation intensity over the surface of the material; however, a number of
important findings can also be obtained for an arbitrary distribution
satisfying rather weak integrability conditions. Figures 4, references 9:
7 Russian, 2 Western.
/171-6900/

EXISTENCE OF SMOOTH SOLUTIONS IN PROBLEMS OF ELECTROMAGNETIC RADIATION
FOCUSING

GONCHARSKIY, A. V. and STEPANOV, V. V., Moscow State University imeni
M. V. Lomonosov

/Abstract/ This study states and solves the inverse problem of electromag-
netic radiation focusing into a plane curve on which the intensity distribu-
tion of the focused radiation is assigned. It is assumed that transforma-
tion of the phase of the incident radiation with the help of an optical
element is sufficient to solve the focusing problem. Using the approxima-
tion of geometrical optics, the problem is reduced to calculating the
eikonal of the wave reflected from the optical element. The theory serves
as the basis of algorithms for synthesizing programmable optical elements
employed for various laser radiation focusing tasks. Figures 2, references:
5 Russian.
/171-6900/

POISSON FORMULA FOR RADON TRANSFORMATION AND NUMERICAL IMAGE RECONSTRUCTION
ALGORITHM

VVEDENSKAYA, N. D. and GINDIKIN, S. G., Information Transmission
Problems Institute, USSR Academy of Sciences, Moscow State University
imeni M. V. Lomonosov

/Abstract/ An algorithm is presented for Radon transform inversion based
on an analog of a Poisson formula, for image reconstruction in sectional
radiography. The algorithm is employed to compute test functions consisting
of the sum of the characteristic functions of circles multiplied by different
constants. The numerical experiments indicated that no regularization is
required when the initial functions are smooth, but it is necessary when
reconstructing discontinuous functions. The study indicates that the trans-
formation formula derived can be employed in computational image reconstruc-
tion algorithms. Figures 4, references: 4 Russian.
/171-690/

A MULTIPOINT BOUNDARY PROBLEM FOR A SYSTEM OF GENERALIZED ORDINARY DIFFEREN-
TIAL EQUATIONS

ASHORDIYA, M.T., Tbilisi State University, Institute of Applied
Mathematics imeni I. N. Vekua.

/Abstract/ The Cauchy-Nicoletti problem

$$\left[x(t_k)\right]_k = \phi_k(x) \quad (k = 1,\ldots,n)$$

is investigated for a system of generalized ordinary differential equations
$dx(t) = dA(t) \cdot f(t, x(t))$. Existance theorems are stated and proved for
the solutions of the system of equations satisfying the boundary conditions.
References 5: 2 Russian, 3 Czech.
/192-690/

ASYMPTOTICALLY STABLE SOLUTIONS OF SOME NONLINEAR EQUATIONS

KIRICHENKO, N. A., Institute of General Physics, USSR Academy of Sciences

[Abstract] A non-linear equation of the form $\dot{u} = (-1)^n (u'' + f(u))^{(2n)}$, where $f(u) = K_0^2 u + \varepsilon u^2 - u^3$, $k_0^2 > 0$, ε is an arbitrary parameter, the dot denotes a time derivative, and $(2n)$ denotes a spatial derivative of order $2n$, was studied on the interval $[0, R]$. Boundary conditions were $u^{(2k+1)}|_{\partial\Omega} = 0$ for k=0,1,2... and n=1,2,... when $X \in \Omega$. This equation is of interest in models of laser heating of gaseous mixtures which include thermal conductivity, diffusion and thermal diffusion effects. The particular case n = 1 was analyzed in detail and compared with the case of n = 0; the results can be generalized to other values of n. The solutions were studied in the limits $R \to \infty$ and $t \to \infty$. The solutions were described in terms of the phase-plane diagram and curves of the quantity $a(2\pi/T) = u_{max} - u_{min}$ were constructed. The solution trajectories were shown to be spatially periodic with the period T satisfying the condition mT = 2R, where m is an integer. The solution with the maximum spatial period, whose phase-plane trajectory connects two consecutive saddle points (no cycles), was shown to be the asymptotically stable solution. This solution was also shown to be the asymptotically stable solution in the limit $t \to \infty$ for finite R. Figures 2, references 10: 6 Russian, 4 Western.
[242-9638]

WORKLOAD SCHEDULE ENSURING THE MOST UNIFORM EMPLOYMENT OF MACHINES

VIZING, V. G., Engineering Institute of the Food Industry imeni
M. V. Lomonosov

[Abstract] An algorithm, consisting of the solution of a series of linear programming problems and employing a lexicographic criterion for optimality, was developed for determining the optimal schedule for the employment of machines servicing ships in port. The optimal schedule minimized the loading vector in the lexicographic sense. The number of operations which must be performed is of polynomial order. An analytic criterion of optimality, based on the assignment of a penalty function for each machine corresponding to its workload, was also considered. In this case, the optimal schedule minimized the total penalty of all machines. This problem

is a problem in convex programming. It was shown that the lexicographic
and analytic criteria always yield optimal solutions and in both cases the
workload of each machine is the same for different optimal schedules.
The two criteria are equivalent only in case when a common penalty function
is assigned to all machines. The problem of scheduling in the presence of
interruptions during job execution were also considered. In this case, the
problem of finding the optimal schedule is NP-difficult. An approximate
algorithm, based on a graph-theoretical method and requiring a number of
operations which is of polynomial order, was constructed for this case.
References 4: all Russian.
/242-963/

UDC 518

PROBLEMS WITH UNCERTAIN INITIAL DATA

TIKHONOV, A. N., Academician, Institute of Applied Mathematics imeni
M. V. Keldysh, USSR Academy of Sciences

/Abstract/ A method for solving linear algebraic equations with uncertain
coefficients and right sides was presented. The method was based on enlarging
the matrix of the system by including in it the uncertainties in the
parameters of the system. It was shown that stable methods for solving the
enlarged system always exist. Such methods were given the name regularized
least-squares methods. References 10: 8 Russian, 2 Western.
/242-963/

UDC 53:51

OPTIMIZATION OF SAMPLING IN STATISTICAL PHYSICS EXPERIMENTS

RAFAILOV, M.Kh.

/Abstract/ This study investigates sample optimization in order to ensure
a steady experimental result in statistical physics, which is determined
by the relationship between the size of the sampling set for the random
quantity in question needed to ensure stationarity of the distribution
function $F(x)$ and the level of significance α when the interaction function
$p(x,t)$ is known a priori. The findings can be applied to problems of
experimental design - determining the optimum sample size necessary and
sufficient for the statistical characteristics of the random quantity

investigated to be stationary, as well as problems of separating
quantities with different statistical properties and thus to identify
anomalies in the phenomena in question. References: 6 Russian.
/212-6900/

UDC 517.986.64

REDUCTIONS OF MANIFOLDS OF RATIONAL CURVES AND ASSOCIATED PROBLEMS OF THE
THEORY OF DIFFERENTIAL EQUATIONS

GINDIKIN, S. G., Moscow State University

/Abstract/ A method is developed for integrating nonlinear differential
equations that extends the method of bi-characteristics. The method is
applied to the problem of the reduction of manifols of rational curves: a
determination is made as to which submanifolds of the manifold of rational
curves are realized as complete families of rational curves on a modified
manifold. Expansions of first-order Hamilton-Jacobi sysiems of equations
are analyzed. Derivative expansions of Monge systems are presented.
Critical systems for Monge systems of differential equations with one
parameter are described. The results of these investigations are then
applied to the construction of complete manifolds of rational curves.
References 15: 11 Russian, 4 Western.
/6900-154/

UDC 517.925.51

nth-ORDER DIFFERENTIAL EQUATIONS WITH SINGULARITY

NIKONENKO, V. V., Odessa Engineering-Construction Institute.

/Abstract/ This study investigates the behavior of real differential
equations of the type

$$\varepsilon(x) y^{(n)} + \sum_{k=1}^{n} a_k(x) y^{(n-k)} = 0,$$

$$\varepsilon(x) y^{(n)} = F(x, y, y', \ldots, y^{(n-1)}),$$

where $\varepsilon(+0) = 0$. Asymptoptic representation of n - 1 linearly independent partial solutions are derived for the first of these, and sufficient conditions are demonstrated for the existence of partial solutions of the type $y^{(k)} = u^{(k)}(x) + 0u_k(x)$ (k = 0, n - 1) for the second, where u, u_k (k = 0, n - 1) are certain known functions. References: 5 Russian. /6900-157/

OPTIMALITY OF PURSUIT TIME IN DIFFERENTIAL MULTIPLE-PLAYER GAME WITH SIMPLE MOVEMENT

RIKHSIYEV, B.B., Institute of Mathematics imeni V. I. Romanovskiy, Uzbek SSR Academy of Sciences.

/Abstract/ Optimality conditions are derived for the pursuit time in a multiple-player differential game with simple movement when the initial position of the pursued player belongs to the convex shell of the initial position of the pursuing players. /6900-161/

CLASS OF LIMITING DISTRIBUTIONS FOR VECTOR-FUNCTION FREQUENCIES OF OCCURRENCE OF EVENTS IN POLYNOMIAL SCHEME

MUKHAMEDKHANOVA, R., Institute of Mathematics imeni V. I. Romanovskiy, Uzbek Academy of Sciences.

/Abstract/ An entire class of limiting (as $N \to \infty$) distributions is established for the functions $H(\cdot)$ of the vector of the frequencies of occurrence of events in a polynomial scheme, where the functions $H(\cdot)$ are sufficiently smooth and explicitly independent of N, while the probabilities of occurrence of the events vary with N (i.e., a series schema is investigated). References 7: 5 Russian, 2 Western. /6900-161/

UDC 539.2

A NEW PROBLEM IN MATHEMATICAL PHYSICS ASSOCIATED WITH THE PROBLEM OF
COHERENT PHASE TRANSFORMATIONS

GRINFEL'D, M.A., Institute of Earth Physics imeni O.Yu. Shmidt, USSR
Academy of Sciences

[Abstract] The description of heterogeneous coherent phase equilibria
in an elastic single-component system is shown to lead, in the approxima-
tion of small 'intrinsic' deformation, to a new problem in mathematical
physics with an unknown bound. The low-order terms of the resulting
system of equilibrium equations coincide with the equations of the classical
linear theory of elasticity (generally speaking, anisotropic); however,
the problem remains strongly nonlinear overall, inasmuch as it contains an
unknown bound and a boundary condition on it which is quadratic with
respect to translation. The formulas obtained are used to find certain
explicit solutions to the boundary problems. As an example, the problem
of heterogeneous equilibria in an infinite rectangular isotropic beam with
free faces and constant loading on the surfaces x^2 = const can be examined.
A modeling problem for the asymptote of small 'intrinsic' deformation
during coherent phase transformation is presented as a scalar analog of
the vector problem considered initially. References 6: 4 Russian,
2 Western.
[129-6900]

UDC 517.91

ASPECTS OF THE THEORY OF THE STABILITY OF SOLUTIONS OF DIFFERENTIAL
EQUATIONS WITH MAXIMA. 1.

NABIYEV, G.M., Scientific Production Association for Space Research.

[Abstract] This study investigates aspects of the stability of solutions
for systems of differential equations with maxima of the type

$$\pi^{\cdot}(t) = F(t, \dot{x}(t), \max_{\tau \in [t-h,t]} x(\ \ ))$$

Previous findings for systems of ordinary differential equations are
extended with minor modifications to the present system with maxima.
Theorems regarding the uniform asymptotic stability of the trivial solution
of the subject system are presented. References 7: 6 Russian, 1 Western.
[145-6900]

NECESSARY AND SUFFICIENT CONDITIONS FOR SINGLE-EXTREMUM AND CONVEX
PROBLEMS OF MATHEMATICAL PROGRAMMINGS

GASANOV, I.I. and RIKUN, A.D., Computer Center, USSR Academy of Sciences;
Water Problems Institute, USSR Academy of Sciences.

[Abstract] Classes of mathematical programming problems are identified
for which each point which satisfies the necessary conditions of the
extremum is a global minimum of the problem. The latter property is
important from the viewpoint of applications, inasmuch as many optimization
algorithms fail to distinguish between extrema and the points which satisfy
the necessary conditions of the extremum. A mathematical programming
problem of the type min $\{f(x)$ $|g_i(x)<0$, $i = 1, 2,\ldots,m$; $h_j(x)=0, j=1,2,$
$\ldots,l\}$ is investigated. This problem is said to be an essentially single-
extremum problem if the sets of local and global minima of the problem
are the same. A function ϕ is introduced which is said to be locally
pseudo-convex (quasi-convex) in x if there exists a vicinity x with respect
to which ϕ is pseudo-convex (quasi-convex) in x. A restriction is
presented for application to the planning of water-protection measures.
References 6: 6 Russian, 1 Western.
[109-6900]

ON THE PROBLEM OF LINEAR PROGRAMMING WITH APPROXIMATE DATA

AGAYAN, G. M., RYUTIN, A. A. and TIKHONOV, A. N.

[Abstract] A regularization problem of linear programming is proposed for
approximately assigned restrictions. Approximate information about the
system of restrictions is provided in the form of an individual approximate
system and of a class of systems equivalent to the individual system in
accuracy. The existence of a unique solution to the corresponding regulari-
zation problem was proved, and stable methods for solving it are proposed.
In a numerical example, the results using are compared with the results of
a solution by the simplex method. References 6 Russian.
[62-6900]

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